FEDERAL CLIMATE ADAPTATION AND RESILIENCE FOR THE 21st CENTURY

HEARING

BEFORE THE

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

OF THE

HOUSE OF REPRESENTATIVES

ONE HUNDRED SEVENTEENTH CONGRESS

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Appendix II: Additional Material for the Record

FEDERAL CLIMATE ADAPTATION AND RESILIENCE FOR THE 21st CENTURY

TUESDAY, MARCH 8, 2022

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, D.C.

The Committee met, pursuant to notice, at 10 a.m., via Zoom, Hon. Haley Stevens [Acting Chairwoman of the Committee] presiding.

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
HEARING CHARTER

Federal Climate Adaptation and Resilience for the 21st Century

Tuesday, March 8, 2022
10:00 AM EDT
Zoom

PURPOSE

The purpose of this hearing is to evaluate the Federal Government's vulnerability to the impacts of climate change, and to assess the status of ongoing efforts to promote greater climate adaptation and resilience throughout Federal programs, operations, and facilities. The hearing will explore the types of climate risks threatening Federal agencies and the urgent need to address those risks in order to protect Federal assets and investments. The hearing will detail the climate challenges confronting NASA, DOE, and NOAA, along with the adaptation and resilience strategies adopted by those agencies to respond to them. Finally, the hearing will discuss potential opportunities to bolster Federal climate adaptation tools, including enhanced interagency resilience collaboration and the incorporation of accurate, up-to-date climate data into agency planning, implementation, and outreach.

WITNESSES

- **Dr. Richard W. Spinrad**, Administrator, National Oceanic and Atmospheric Administration
- **Ms. Ingrid Kolb (pronounced Cobb)**, Director, Office of Management, and Chief Sustainability Officer, Department of Energy
- **Dr. Joel R. Carney**, Assistant Administrator, Office of Strategic Infrastructure, and Chief Sustainability Officer, National Aeronautics and Space Administration
- **Mr. Alfredo Gomez**, Director, Natural Resources and Environment, Government Accountability Office

Key Questions

- What are the Federal Government's vulnerabilities to climate change impacts?
- How are Federal agencies such as NASA, DOE, and NOAA identifying urgent climate risks and developing adaptation and resilience strategies to address them?
- How can Federal science agencies maximize the use of their scientific programs and capabilities to promote climate adaptation efforts?
- What opportunities exist to strengthen interagency collaboration in support of climate adaptation and resilience?
- What level of resource support will be required for Federal agencies to effectively protect their programs and infrastructure against climate impacts in the coming decades?

Definitions

The terms vulnerability, adaptation and resilience have distinct meanings in the context of climate change. NOAA's Climate.gov defines each term as follows:[1]

- *Vulnerability*: The propensity or predisposition of assets to be adversely affected by hazards. Vulnerability encompasses exposure, sensitivity, potential impacts, and adaptive capacity.
- *Adaptation*: The process of adjusting to new (climate) conditions in order to reduce risks to valued assets.
- *Resilience*: The capacity of a community, business, or natural environment to prevent, withstand, respond to, and recover from a disruption.

Executive Order 14008

On January 27, 2021, President Biden issued Executive Order 14008, entitled *Tackling the Climate Crisis at Home and Abroad*.[2] Section 211 of Executive Order 14008 directed Federal agencies to create "action plans" that would describe "steps the agency can take with regard to its facilities and operations to bolster adaptation and increase resilience to the impacts of climate change." The executive order designated the Federal Chief Sustainability Officer (CSO), within the White House Council on Environmental Quality (CEQ), as the lead official charged with supporting and coordinating agency action plans across the executive branch. On October 7, 2021, the White House released the first group of plans, identified as Climate Adaptation and Resilience Plans, encompassing 23 agencies across the Federal Government.[3] The agencies are now working to implement their plans. Annual progress updates will be completed later in 2022.

Agency Climate Adaptation and Resilience Plans

The 23 agencies that released Climate Adaptation and Resilience Plans in October 2021 represent a diverse cross-section of Federal programs and activities.[4] Nevertheless, common themes did emerge from the plans. The Federal CSO identified five broad challenges for Federal agency climate adaptation and resilience planning:

- Safeguarding Federal investments by incorporating climate impacts into agency planning processes, such as facility design and long-term budgeting;
- Ensuring clear leadership and accountability among top agency officials for promoting climate adaptation and resilience;
- Developing more resilient agency supply chains that can properly support the procurement capabilities necessary to strengthen climate adaptation;
- Reinforcing the resilience of the Federal workforce by protecting Federal employees from climate impacts and promoting climate education for Federal employees; and

[1] https://toolkit.climate.gov/content/glossary
[2] https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/
[3] https://www.whitehouse.gov/briefing-room/statements-releases/2021/10/07/fact-sheet-biden-administration-releases-agency-climate-adaptation-and-resilience-plans-from-across-federal-government/
[4] https://www.sustainability.gov/adaptation/

- Promoting equity in Federal climate adaptation and resilience activities by ensuring that climate impacts for environmental justice communities are fully considered.

The Federal CSO also noted that the Federal Government's scientific agencies and infrastructure possess distinct vulnerabilities and objectives within the broader climate adaptation and resilience framework. Particular challenges for scientific agencies include the need to mitigate climate vulnerabilities among expensive, technically complex physical assets with unique operational requirements, such as NASA launch facilities and DOE national laboratories; the responsibility to improve interagency data sharing processes for Federal climate data; and the obligation to provide technical support for non-scientific agencies seeking to integrate climate data more effectively into their programs and planning activities.

The National Aeronautics and Space Administration (NASA), the Department of Energy (DOE), and the Department of Commerce (DOC) – which includes the National Oceanic and Atmospheric Administration (NOAA) – all submitted Climate Adaptation and Resilience Plans in accordance with Executive Order 14008. Brief overviews are provided below.

NASA

The unique requirements of NASA's highly specialized asset infrastructure create significant climate vulnerabilities for core agency functions. In its Climate Adaptation and Resilience Plan,[5] NASA notes that fully two-thirds of its assets (measured by replacement value) are located within 16 feet of mean sea level along America's coastlines. As a result, facilities that are essential to NASA's ability to fulfill its mission are "imminently threatened" by climate impacts such as sea level rise, as well as changes in temperature and precipitation intensity. For example, Kennedy Space Center already requires periodic beach renourishment to protect launch-related mission assets, while Johnson Space Center's location on the Gulf Coast exposes it to heightened risks from storm surge and coastal flooding. Moreover, many of these assets cannot be relocated due to "strict launch requirements," such as general safety measures and the need to maintain a required distance from communities during launch activities, and thus must remain coastal. NASA asserts that "flooding and other natural forces exacerbated by climate change continue to pose significant risk to NASA's launch infrastructure and mission."

To further highlight the agency's potential cost exposure to climate risk, NASA summarizes "Disaster Recovery Expenditures" for agency facilities related to extreme events such as hurricanes and flooding since 2003. According to the agency, total recovery expenditures during this period exceeded $1 billion and were funded outside of the normal budget cycle.

In addition to its own climate vulnerabilities, NASA's plan details the agency's role as a source of climate research and data that will be critical to supporting greater climate adaptation and resilience across the Federal Government. NASA's climate research programs, which extend to numerous aspects of climate change from sea level rise and global ice measurements to solar activity and atmospheric temperatures, supply crucial data for climate models that can be shared and adopted by other Federal agencies attempting to better understand their climate vulnerabilities. NASA's responsibility to bolster the broader Federal climate resilience effort

[5] https://www.sustainability.gov/pdfs/nasa-2021-cap.pdf

while simultaneously addressing its own climate vulnerabilities reflects the dual role of science-based agencies throughout the Federal Government.

NASA identifies five "priority adaptation actions" that the agency will undertake to achieve its climate adaptation and resilience objectives:

1. *Ensure Access to Space*: Identify and mitigate climate vulnerabilities related to critical launch facilities, supporting infrastructure, and the agency's supply chain;
2. *Integrate Climate Adaptation into Agency and Center Master Plans*: Update existing master plans, at both the Agency and Center level, to incorporate climate adaptation;
3. *Integrate Climate Risks into Agency Risk Analysis and Resilience Planning*: Develop a new "Agency Resilience Framework" that will explicitly consider climate resilience, as well as new "Center Resilience Plans" that will assess vulnerabilities for each Center;
4. *Update Climate Modeling to Enable Better Understanding of Agency Threats and Vulnerabilities*: Develop "next generation climate models" that can more robustly support downscaled climate projections to facilitate asset-level vulnerability evaluations;
5. *Advance Aeronautics Research on Technologies and Processes that Reduce Contributors to Climate Change*: Promote aviation research that reduces the vulnerability of agency assets to extreme weather events.

NASA identifies several further initiatives that will support its climate adaptation and resilience strategy, including coordinated efforts to enhance climate literacy throughout the agency workforce and the comprehensive incorporation of climate risk considerations into agency management functions.

DOE

DOE oversees a sprawling and intricate asset infrastructure that exposes the agency's unique scientific facilities and laboratories to a range of climate impacts. DOE's Climate Adaptation and Resilience Plan[6] therefore emphasizes the need to "successfully identify risks, hazards, and vulnerabilities from climate change that have the potential to impact operations" in order to devise adaptation strategies and maintain the agency's operational capacity. DOE has already completed screenings and vulnerability assessments at 51% of agency sites using guidance from its 2021 Vulnerability Assessment and Resilience Plan (VARP) as well as related guidance from earlier initiatives. The agency describes a number of ongoing projects intended to address climate vulnerabilities and boost the climate resilience of specific facilities. For example:

- The National Energy Technology Laboratory (NETL) has identified climate risks due to more frequent and severe droughts, heat waves and storms at different sites in Oregon, West Virginia, and Pennsylvania. The sites are striving to bolster their electricity and water resilience through measures such as cooling tower renovations, boiler and chiller replacements, and energy efficiency upgrades.
- The Idaho National Laboratory (INL) has determined that climate risks stemming from rising summer temperatures and increased drought conditions pose a heightened risk of disruption to the proper functioning of the facility's laboratories. INL is undertaking

[6] https://www.sustainability.gov/pdfs/doe-2021-cap.pdf

"major renovation efforts," such as modernizing HVAC control systems and installing new air volume hoods, in order to reduce lab energy usage and improve the control of pressure and temperature within each lab space to preserve safety standards.

DOE identifies five "priority adaptation actions" that the agency will undertake to achieve its climate adaptation and resilience objectives:

1. *Assess Vulnerabilities and Implement Resilience Solutions at DOE Sites*: Conduct site-level vulnerability assessments and develop site-level resilience plans;
2. *Enhance Climate Adaptation and Mitigation Co-Benefits at DOE Sites*: Promote dual climate adaptation and mitigation policies such as reducing facility energy demand;
3. *Institutionalize Climate Adaptation and Resilience Across DOE Policies, Directives and Processes*: Formalize the use of up-to-date climate data in support of adaptation and resilience across agency orders, directives, policies, and processes;
4. *Provide Climate Adaptation Tools, Technical Support, and Climate Science Information*: Utilize agency scientific capabilities, such as Argonne National Laboratory's High Performance Computing (HPC) system, to assess climate models and support the development of climate adaptation policies throughout the agency;
5. *Advance Deployment of Emerging Climate Resilient Technologies*: Support research and development projects for innovative technologies that can enhance the resilience of DOE facilities, as well as assets across the Federal Government.

DOE identifies several further initiatives that will support its climate adaptation and resilience strategy, including the creation of an agency hub for climate change resources to enhance the climate literacy of the agency workforce and an effort to analyze the climate vulnerabilities of the agency's supply chain.

NOAA

NOAA did not prepare its own distinct Climate Adaptation and Resilience Plan, but the agency occupies a prominent role within the DOC adaptation and resilience strategy.[7] DOC's plan notes that NOAA possesses climate vulnerabilities across the breadth of its geographically and technically diverse asset infrastructure, including supply chain vulnerabilities in support of its ships and aircraft, as well as agency systems, equipment and electronics that may confront weather conditions beyond their existing "operating parameters and capacities." NOAA is currently overseeing "a phased approach to facility planning" that includes updated climate risk assessments to identify the agency facilities that are most vulnerable to climate impacts, along with new strategies to incorporate adaptation principles into facility planning, design, and investment decisions. For example, NOAA has implemented new design requirements that improve the climate resilience of its pier structures and support facilities by increasing their ability to protect agency ships from stronger hurricanes.

Beyond the climate vulnerabilities and mitigation strategies for its own infrastructure, NOAA is also charged with supporting adaptation and resilience planning by other Federal agencies (as well as society at large) through the sharing of climate data and models. DOC identifies NOAA

[7] https://www.sustainability.gov/pdfs/doc-2021-cap.pdf

as a leader in this area for Federal interagency cooperation. NOAA identifies three primary implementation methods to achieve this objective:

1. *Engaging with Partners / Providing Technical Assistance*: Conduct outreach to Federal, state, and local stakeholders and communities to assist with climate adaptation planning, deliver targeted climate data and information, and support the prioritization of adaptation and resilience measures;
2. *Information/Tools/Services*: Expand and broadly disseminate the agency's "suite" of programs, models, and guidance documents to provide scientific support for climate adaptation and resilience actions across society. Examples include NOAA's Effects of Sea Level Rise Program[8] that projects habitat vulnerability to sea level rise; the National Water Model[9] that forecasts projected water levels in rivers and streams; and the U.S. Climate Resilience Toolkit[10] for public and private sector stakeholders;
3. *Grants*: Execute grant programs and award grants to "advance the climate science that informs resilience measures," as well as furthering the scientific understanding, planning, and implementation of "nature-based approaches to climate adaptation."

Additionally, NOAA is a co-lead agency (along with NIST) in supporting "the development of climate-ready infrastructure via the development of forward-looking building standards." As a part of this objective, NOAA is responsible for providing climate data, projections, and decision-support tools to assist the building science community and inform climate resilient building codes and standards. Initial efforts at the Federal level will be guided through existing inter-agency programs and partnerships that support climate resilient infrastructure planning.

GAO Assessment Framework for Climate Vulnerability, Adaptation and Resilience

The Government Accountability Office (GAO) possesses several analytical tools to evaluate climate vulnerabilities, as well as adaptation and resilience actions, among Federal agencies. GAO's Disaster Resilience Framework offers a guide for assessing the resilience of Federal programs and infrastructure to natural disasters.[11] The framework emphasizes the importance of accurate information for agency decisionmakers in understanding disaster risk, as well as the need to integrate information into a coordinated response and incentivize investments to reduce risk and enhance resilience. The framework considers the increased rate of natural disasters due to climate change as a key factor for the ability of agencies to make informed decisions.

GAO's High Risk List currently identifies the Federal Government's fiscal exposure to climate change impacts as a "high risk area" for Federal agencies, based in part upon the Federal Government's role as an owner and operator of facilities and infrastructure.[12] GAO highlights the need for Federal strategic leadership in promoting climate adaptation and resilience to reduce fiscal exposure, as well as the importance of Federal activities to provide climate data and technical assistance within that effort.

[8] https://coastalscience.noaa.gov/research/coastal-change/ecological-effects-sea-level-rise-program/
[9] https://water.noaa.gov/about/nwm
[10] https://toolkit.climate.gov/
[11] https://www.gao.gov/products/gao-20-100sp
[12] https://www.gao.gov/highrisk/limiting-federal-governments-fiscal-exposure-better-managing-climate-change-risks

GAO has also issued numerous reports that address climate vulnerabilities and mitigation strategies to some extent, including:

- "U.S. Postal Service: Better Use of Climate Data Could Enhance the Climate Resilience of Postal Facilities" (GAO-21-104152)[13]
- "Climate Change: Improved Federal Coordination Could Facilitate Use of Forward-Looking Climate Information in Design Standards, Building Codes, and Certifications" (GAO-17-3)[14]
- "Climate Information: A National System Could Help Federal, State, Local, and Private Sector Decision Makers Use Climate Information" (GAO-16-37)[15]

Challenges and Next Steps for Federal Climate Adaptation and Resilience

Agencies described several common challenges for the implementation of their Climate Adaptation and Resilience Plans. One obstacle cited in multiple plans was the high upfront cost of many proposed adaptation actions, along with resource constraints and funding shortfalls for their execution.[16] Budgetary concerns arose in relation to an array of agency adaptation and resilience requirements, including facility upgrades, partner outreach and staff support. Another difficulty was the need for improved interagency coordination, particularly regarding the sharing and use of updated Federal climate data for agency planning decisions.[17] A third recurring impediment was the lack of climate awareness among many Federal employees engaged in activities that confront climate risks, and the importance of sustained climate education in order to integrate adaptation and resilience throughout agency planning and operations.[18]

Agency updates to the Climate Adaptation and Resilience Plans will be submitted to the Federal CSO later in 2022. The Federal CSO can provide technical assistance to agencies as they update their plans on an ongoing basis. However, the nature of those updates – including the process by which agencies will continually review and measure their progress towards climate adaptation and resilience goals – remains uncertain. Additionally, under President Biden's Executive Order 14057 (*Executive Order on Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability*) issued on December 8, 2021, agency climate adaptation and resilience efforts will interact with a new Climate Adaptation and Resilience Federal Leaders Working Group.[19] The working group will promote interagency collaboration and knowledge sharing in aspects such as disseminating climate data and reinforcing Federal supply chains.

[13] https://www.gao.gov/products/gao-21-104152
[14] https://www.gao.gov/products/gao-17-3
[15] https://www.gao.gov/products/gao-16-37
[16] https://subscriber.politicopro.com/article/eenews/2021/10/08/cost-data-trust-agencies-see-a-struggle-in-climate-prep-281750
[17] *Id.*
[18] *Id.*
[19] https://www.sustainability.gov/federalsustainabilityplan/resilience.html

Chairwoman STEVENS. Without objection, the Chair is authorized to declare recess at any time. And before I deliver opening remarks, I wanted to note that obviously today's Committee hearing is meeting virtually.

Just a couple of reminders that Members are well familiar with about the conduct of this hearing. First, Members should keep their video feed on for as long as they're present in the hearing. Members are certainly responsible for their own microphones. Please also keep your microphone muted unless you are speaking. And finally, if Members have documents that they wish to submit for the record, please email them to the Committee Clerk, whose email address was circulated prior to the hearing.

And so good morning to all of my colleagues, and thank you to our witnesses for joining us here today. I look forward to an excellent discussion that will signify the extent to which Federal climate adaptation and resilience is a priority for the Committee, the hearing on "Federal Climate Adaptation and Resilience for the 21st Century." I think we're all excited to be a part of this hearing, and I'm particularly proud to lead this hearing because this is an issue that resonates with anyone who cares about making the Federal Government work for the American people.

On the Science Committee we see all the time the incredible things that the Federal Government can do. We see NOAA (National Oceanic and Atmospheric Administration) develop forecasts and models that have revolutionized our understanding of the natural world and that will save lives when extreme weather threatens our communities. We see the Department of Energy (DOE) invest in groundbreaking technologies that change the boundaries of what we think is possible. We see NASA (National Aeronautics and Space Administration) push the limits of human knowledge beyond even our planet itself. I truly believe that all of us on both sides of the aisle are committed to supporting the missions of these agencies and ensuring that they can get the job done.

Climate change is a threat to these agencies and our entire Federal Government that simply cannot be ignored. By now, we are all too familiar with the litany of climate risks that confront our society. Rising sea levels and more frequent coastal floods, dangerous wildfires sparked by higher temperatures, and longer, more intense droughts, intense precipitation that overwhelms flood protections, and many more.

Federal agencies are a part of our society as well, and they must adapt along with the rest of us. As the owners of a vast and complex asset infrastructure, agencies like NOAA, DOE, and NASA are vulnerable to the full spectrum of climate impacts. The testimony of our witnesses today will make clear that NASA is facing challenges. Their launch facilities, which are essential to the agency's missions, are coastal and gravely threatened by sea-level rise. DOE's national laboratories, the jewel of American scientific research, are grappling with the need to maintain safety protocols under more extreme weather conditions. NOAA's finely tuned instruments and platforms which generate data that underpin so much vital scientific work are increasingly operating in conditions beyond their designated operating parameters.

Climate change is not an abstract phenomenon for these agencies and further Federal agencies across the executive branch. It is a concrete, tangible danger that could undermine core agency functions if not properly addressed. The answer, as we will discuss in this hearing, is to bolster climate adaptation and resilience processes throughout the Federal Government to ensure that facilities are protected, operations are insulated, and future investments are made wisely. Federal agencies must adapt to climate risk and strengthen the resilience to climate impacts.

It's not going to be easy. Agencies need a detailed understanding of their own climate vulnerabilities. They will need to update their planning processes to account for these vulnerabilities. They will need to incorporate climate data into basic management functions, and they will need to teach their work forces how to interpret that data accurately. Finally, they will need the resources and the support to implement their adaptation and resilience strategies. It will be a large undertaking, and it will take sustained effort over many years. But it is necessary, and I believe there will be bipartisan support for it.

Protecting the capabilities of Federal agencies like NOAA, DOE, and NASA is a shared goal for all of us. We should also realize that climate change not—does not only threaten Federal science agencies; it also highlights how vital their work truly is. The scientific assets that must be protected from climate impacts are the very assets that will lead the way in strengthening adaptation and resilience.

NOAA, NASA, and DOE produce climate data, create climate-resilient technologies, and operate advanced scientific tools that will provide the foundation for climate adaptation and resilience across the Federal Government. They can lead the way not only to protect themselves but also to educate their fellow agencies about how to do the same. This is an innovation in action. I am eager to hear more about how Federal science agencies can enhance their interagency cooperation to the benefit of the entire government.

Again, I want to thank our witnesses for testifying before the Committee today. And as representatives of NOAA, DOE, NASA, and GAO (Government Accountability Office), you're—you are leaders in preparing the Federal Government for climate change and working to mitigate for climate change legislation that will be forthcoming. You are also confronting your own agency's efforts and for the government as a whole. You can help us to understand the true scale of this challenge, as well as the best ways for Congress to support adaptation and resilience strategies in the years to come. Thank you for your commitment to public service and for the important work you do.

[The prepared statement of Chairwoman Stevens follows:]

Good morning to all of my colleagues and thank you to all of our witnesses for joining us here today. I look forward to an excellent discussion that will signify the extent to which Federal climate adaptation and resilience is a priority for the Committee.

I'm very excited to lead this hearing because this is an issue that should resonate with anyone who cares about making the Federal Government work for the American people. On the Science Committee, we see all the time the incredible things that the Federal Government can do. We see NOAA develop forecasts and models that have revolutionized our understanding of the natural world—and that save lives when extreme weather threatens our communities. We see the Department of

Energy invest in groundbreaking technologies that change the boundaries of what we think is possible. We see NASA push the limits of human knowledge beyond even our planet itself. I truly believe that all of us, on both sides of the aisle, are committed to supporting the missions of these agencies and ensuring that they can get the job done.

Climate change is a threat to these agencies and the entire Federal Government that cannot be ignored. By now, we are all too familiar with the litany of climate risks that confront our society: rising sea levels and more frequent coastal floods; dangerous wildfires sparked by higher temperatures and longer, more intense droughts; intense precipitation that overwhelms flood protections; and many more. Federal Agencies are part of our society as well, and they must adapt along with the rest of us.

As the owners of a vast and complex asset infrastructure, agencies like NOAA, DOE, and NASA are vulnerable to the full spectrum of climate impacts. The testimony of our witnesses today will make that clear. NASA's launch facilities, which are essential to the agency's mission, are coastal and gravely threatened by sea level rise. DOE's National Laboratories, a jewel of American scientific research, are grappling with the need to maintain safety protocols under more extreme weather conditions. NOAA's finely tuned instruments and platforms, which generate data that underpins so much vital scientific work, are increasingly operating in conditions beyond their designed operating parameters. Climate change is not an abstract phenomenon for these agencies, and for their fellow agencies across the executive branch. It is a concrete, tangible danger that could undermine core agency functions if not properly addressed.

The answer, as we will discuss in this hearing, is to bolster climate adaptation and resilience processes throughout the Federal Government. To ensure that facilities are protected, operations are insulated, and future investments are made wisely, Federal agencies must adapt to climate risk and strengthen their resilience to climate impacts. It will not be easy. Agencies will need a detailed understanding of their own climate vulnerabilities. They will need to update their planning processes to account for these vulnerabilities. They will need to incorporate climate data into basic management functions, and they will need to teach their workforces how to interpret that data accurately. Finally, they will need the resources and the support to implement their adaptation and resilience strategies. It will be a large undertaking and it will take sustained effort over many years. But it is necessary, and I believe there will be bipartisan support for it. Protecting the capabilities of Federal agencies like NOAA, DOE, and NASA is a shared goal for all of us.

We should also realize that climate change does not only threaten Federal science agencies—it also highlights how vital their work truly is. The scientific assets that must be protected from climate impacts are the very assets that will lead the way in strengthening adaptation and resilience. NOAA, NASA, and DOE produce climate data, create climate-resilient technologies, and operate advanced scientific tools that will provide the foundation for climate adaptation and resilience across the Federal Government. They can lead the way—not only to protect themselves, but also to educate their fellow agencies about how to do the same. I am eager to hear more about how Federal science agencies can enhance inter-agency cooperation to the benefit of the entire government.

I want to think all of our witnesses for testifying before the Committee today. As representatives of NOAA, DOE, NASA, and GAO, you are leaders in preparing the Federal Government for climate change and working to mitigate the climate impacts confronting your own agencies and the government as a whole. You can help us to understand the true scale of this challenge, as well as the best ways for Congress to support adaptation and resilience strategies in the years to come. Thank you all for your commitment to public service and for the important work that you do.

I now yield to Ranking Member Lucas for his opening statement.

Chairwoman STEVENS. And now, I will yield to Ranking Member Lucas for his opening statement.

Mr. LUCAS. Thank you, Chairwoman Stevens.

As many of my neighbors in rural Oklahoma can tell you, droughts are getting longer, heat waves are getting hotter, and the task of anticipating and managing risk from the environment has gotten more challenging. Extreme weather events can take lives and destroy property if we don't prepare for them.

I know that many of these trends are related to the changing climate, and their effect could continue to grow in the future. In addi-

tion to our work in reducing emissions and combating climate change, we must also adapt to what we are currently facing. We've long recognized environmental risks for individuals and communities, which is why we've tasked agencies like NASA, NOAA, and DOE to provide tools and services to help prepare for and recover from severe events. But as we continue to confront a changing environment across the Nation, we must ensure that our Federal infrastructure is also protected and prepared to adopt.

We're in the midst of an unprecedented investment in our infrastructure, and this Committee has been a driving force when it comes to increasing support for Federal research infrastructure. Recognizing that a world-class science enterprise requires world-class facilities and equipment, we invested heavily in infrastructure in the *DOE Science for the Future Act,* the *NSF for the Future Act,* and the *NIST for the Future Act.*

In addition to preserving the facilities and instruments the Federal Government has already spent billions to build or acquire, these bipartisan bills call for more construction and additional facilities, projects, and tools that will ensure the U.S. research enterprise remains on the cutting edge and attracts world-renowned talent. I expect that, as part of this investment, agencies will ensure that they are considering a future where weather is more extreme and the risk for unique environmental events might be higher. Planning ahead is just as important as putting a shovel in the ground quickly.

So let me issue a serious marker for the future. As a part of our support for increased investment in Federal research infrastructure, I do not expect to have another hearing in 5 years where the same agencies before us today come and testify their facilities are suffering because of environmental changes. We have the ability to identify those risks now, and we should start to work to overcome them immediately or, at the very least, position ourselves to mitigate their most harmful effects in the future. That responsibility falls on each Federal agency.

This preparation also extends beyond existing facilities into the many new clean energy projects and demonstrations being implemented as a result of the *Infrastructure Investments and Jobs Act (IIJA).* There is an unprecedented amount of money being spent through this legislation, which makes oversight and careful planning more important than ever. As money for brick-and-mortar projects goes out the door, we need to be sure this money is spent carefully on projects built to last. Long-term operations should be a priority, and consideration of climate risk is a part of that. A lack of forward-looking planning would be just as wasteful as building an instrument that doesn't work.

Additionally, we have an obligation to provide our citizens the most accurate information on climate and weather events so that they can make informed decisions for their own well-being and resiliency. Today's hearing offers an opportunity for each agency to inform us about the adaption tools they offer taxpayers and how those tools are being adjusted for changes in future climate risk. Personally, I believe that is best done by maximizing our resources through partnerships with private-sector and academic institutions. I look forward to hearing from NASA and NOAA on how they plan

to identify and utilize new commercial data related to atmospheric and weather behaviors.

I also look forward to hearing from DOE on how their new demonstrations and pilot projects are bringing in partners from institutions of higher education and industry to help commercialize these groundbreaking tools. All in all, I think today's hearing is a timely topic and one I'm sure we'll look back on as a productive precursor. I look forward to hearing each of our witnesses' testimony, and I thank you, Madam Chairman, and I yield back the balance of my time.

[The prepared statement of Mr. Lucas follows:]

Thank you, Chairwoman Johnson.

As any one of my neighbors in rural Oklahoma could tell you, droughts are getting longer, heat waves are getting hotter, and the task of anticipating and managing risks from the environment has gotten more challenging. Extreme weather events can take lives and destroy property if we don't prepare for them.

We know that many of these trends are related to the changing climate and their effect could continue to grow in the future. In addition to our work in reducing emissions and combating climate change, we must also adapt to what we're currently facing.

We've long recognized environmental risks for individuals and communities, which is why we've tasked agencies like NASA, NOAA, and DOE to provide tools and services to help prepare for and recover from severe events. But as we continue to confront a changing environment across the nation, we must ensure that our federal infrastructure is also protected and prepared to adapt.

We're in the midst of unprecedented investment in our infrastructure. And this Committee has been a driving force when it comes to increasing support for federal research infrastructure. Recognizing that a world-class science enterprise requires world-class facilities and equipment, we invested heavily in infrastructure in the *DOE Science for the Future Act,* the *NSF for the Future Act,* and the *NIST for the Future Act.*

In addition to preserving the facilities and instruments the federal government has already spent billions to build or acquire, these bipartisan bills call for more construction and additional facilities, projects, and tools that will ensure the U.S. research enterprise remains on the cutting edge and attracts world renowned talent. I expect that as part of this investment, agencies will ensure they are considering a future where weather is more extreme and the risks for unique environmental events might be higher. Planning ahead is just as important as putting a shovel in the ground quickly.

So let me issue a serious marker for the future. As part of our support for increased investment in federal research infrastructure, I do not expect to have another hearing in five years where the same agencies before us today come testify that their facilities are suffering because of environmental changes. We have the ability to identify those risks now, and we should start to work to overcome them immediately. Or at the very least, position ourselves to mitigate their most harmful effects in the future. That responsibility falls on each federal agency.

This preparation also extends beyond existing facilities and to the many new clean energy projects and demonstrations being implemented as a result of the *Infrastructure Investments and Jobs Act.* There is an unprecedented amount of money being spent through this legislation, which makes oversight and careful planning more important than ever. As money for brick-and-mortar projects goes out the door, we need to be sure this money is spent carefully on projects built to last. Long-term operations should be a priority and consideration of climate risk is part of that. A lack of forward-looking planning would be just as wasteful as building an instrument that doesn't work.

Additionally, we have an obligation to provide our citizens the most accurate information on climate and weather events so that they can make informed decisions for their own well-being and resiliency. Today's hearing offers an opportunity for each agency to inform us about the adaptation tools they offer taxpayers and how those tools are being adjusted for changes in future climate risks. Personally, I believe that is best done by maximizing our resources through partnerships with the private sector and academic institutions. I look forward to hearing from NASA and NOAA on how they plan to identify and utilize new commercial data related to atmospheric and weather behaviors.

I also look forward to hearing from DOE on how their new demonstrations and pilot projects are bringing in partners from institutions of higher education and industry to help commercialize these groundbreaking tools. All in all, I think today's hearing is a timely topic and one I am sure we will look back on as a productive precursor. I look forward to hearing each of our witnesses' testimony.

Thank you Madam Chair and I yield back the balance of my time.

Chairwoman STEVENS. Well, it's in the record for all of time, "productive precursor," so this is just a great start to today's hearing. And if there are other Members who wish to submit additional opening statements, your statements will be added to the record at this point.

[The prepared statement of Chairwoman Johnson follows:]

I want to begin by thanking all of my colleagues on both sides of the aisle for joining me here today to discuss this important topic.

The subject of this hearing is Federal climate adaptation and resilience. In other words, our focus will be the need for the Federal Government to protect itself from the impacts that climate change will bring in the years and decades to come.

Democrats and Republicans, on this Committee and throughout the Congress, hold different views on many aspects of climate policy, and those debates will continue. But within a topic that all too often divides us, this is one area where we share a common goal. So many vital Federal programs—important to all of us and backed by longstanding bipartisan support—are now vulnerable to climate change. We must support efforts to bolster Federal resilience in order to ensure that these programs continue to deliver needed results for our constituents and the country as a whole.

Climate impacts can take many forms: rising sea levels, higher temperatures, and more severe droughts and wildfires, to name only a few. For Federal agencies, the implications are clear. Coastal infrastructure is vulnerable to flooding. Facilities that require large amounts of energy confront stressed local power grids. In every region of the country, Federal assets are exposed to climate risks that threaten their programmatic missions.

Three agencies will testify today about these risks, as well as their adaptation and resilience strategies to address them. NASA, the Department of Energy, and NOAA perform critical functions for the American people. This Committee has a long history of supporting them and working to bolster their ability to achieve their missions.

The challenge posed by climate change is no different. When NASA launch facilities are threatened by sea level rise; when DOE National Laboratories experience environmental conditions that strain energy supplies and safety protocols; when NOAA platforms are forced to operate in more difficult environments than originally intended-well, those are challenges that will need to be overcome. But to properly do so, we need to fully understand the threat, and we need to know what steps the agencies are already planning to assess that threat and mitigate it.

There is opportunity here as well. These three agencies are among the most powerful engines of the Federal scientific enterprise. They can play a critical role in generating climate data and disseminating that information to other agencies. They can and should lead the way in strengthening inter-agency coordination and educating other agencies about their climate risks in order to boost climate adaptation and resilience across the entire Federal Government.

I am grateful to our witnesses for appearing before us today. Your perspectives as representatives of NOAA, DOE, NASA, and GAO will help us to understand the scale of the problem for your respective agencies and for the government as a whole. Your testimony will help us to think about the best ways for Congress to support ongoing efforts to improve Federal climate adaptation and resilience, and in doing so, protect Federal programs and investments for the long term. I thank each of you for your commitment to public service.

I now yield to Ranking Member Lucas.

Chairwoman STEVENS. I would also at this time like to introduce our witnesses. So our first witness is Dr. Richard Spinrad. Dr. Spinrad is the Under Secretary of Commerce for Oceans and Atmosphere, as well as the Administrator of the National Oceanic and Atmospheric Administration, otherwise known as NOAA. He is responsible for developing NOAA's portfolio of products and serv-

ices to address the climate crisis, enhance environmental sustainability, and foster economic development. Dr. Spinrad previously served as NOAA's Chief Scientist and lead of NOAA's Office of Oceanic and Atmospheric Research during President Obama's Administration. He also served as the U.S. Permanent Representative to the United Nations Intergovernmental Oceanographic Commission from 2005 to 2009.

Our next witness is Ms. Ingrid Kolb. Ms. Kolb is the Department of Energy's Chief Sustainability Officer and Director of the Office of Management. The Office of Management oversees sustainability, acquisition management, real property management, and personal property management for DOE. Ms. Kolb also served as Deputy Director when the Office of Management was first established in 2005. Prior to her time with DOE, Ms. Kolb worked as the Chief of Staff to the Chief Financial Officers of both DHS (Department of Homeland Security) and OMB (Office of Management and Budget).

Our third witness is Dr. Joel Carney. Dr. Carney is the Assistant Administrator for the Office of Strategic Infrastructure or OSI, as well as NASA's Chief Sustainability Officer. OSI leads NASA's Environmental Management Division, Logistics Management Division, Facilities and Real Estate Division, and the Space Testing Management Office. As head of OSI, Dr. Carney leads NASA's posture on climate change and environmental sustainment. Previously, Dr. Carney was the Deputy Associate Administrator for Mission Support Operations for NASA's Mission Support Directorate where he managed agency infrastructure, risk, and operational transformation.

Following from Dr. Carney is Mr. Alfredo Gomez. Mr. Gomez is the Director in the Natural Resource and Environmental Team of the U.S. Government Accountability Office, otherwise known as GAO. He manages the team's work in environmental protection issues. His portfolio includes work in cleanup of hazardous substances, drinking and clean water issues, ecosystem restoration, pesticides, toxic chemicals, climate change, and EPA- (Environmental Protection Agency-) wide management issues. Mr. Gomez has produced numerous reports and testimonies addressing a wide range of environmental, natural resource, agency management, and food safety issues.

I don't know about all of you, but these bios get me very fired up for the testimonies to follow.

So as our witnesses should know, you're each going to have five minutes for your spoken testimony. Your written testimony will be included in the record for the hearing. When all of you have completed your spoken testimony, we're going to begin with Member questions, and each Member's going to have five minutes to question this phenomenal panel.

So with that, we will start with Dr. Spinrad for five minutes of oral testimony.

TESTIMONY OF DR. RICHARD SPINRAD, ADMINISTRATOR, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Dr. SPINRAD. Chairwoman Stevens, Ranking Member Lucas, Members of the Committee, thank you for this opportunity to testify today.

Since its inception in 1970, NOAA has been a world leader in climate science and services, providing actionable environmental information that is the basis of smart policy and decisionmaking in the changing world. NOAA plays a unique role in the climate arena because we work along the entire lifecycle from climate data collection to research and modeling to product development and dissemination and continuous assessment. And we are mandated to make our data operational, providing actionable information to both the public and private sectors that protects lives and livelihoods and fuels the economy.

In addition to helping other agencies and communities prepare for climate impacts, NOAA is working to ensure that our own operations are resilient to the impacts of climate change. NOAA facilities, like all infrastructure across the Nation, are exposed to the full range of weather and climate extremes, and in some cases their aging condition increases their vulnerability.

We are in the last phase of a strategic review of facility vulnerabilities to extreme weather and climate change such a sea-level rise. We're using NOAA science to inform our facilities' decisions and have salient examples of ways we've managed our facilities' projects to better withstand climate impacts. A recent example is the Ketchikan Homeport Recapitalization Project in Alaska. The floating pier, which will homeport our Fairweather survey vessel, will be designed to withstand rising sea levels due to climate change. The pier's reconstruction also entails a significantly reduced carbon footprint.

Information is power, and we share our climate data publicly and directly with users through our many partnerships and boots-on-the-ground activities across the country. We also regularly equip our interagency colleagues with climate data products and services that they need to make informed decisions to minimize exposure to extreme weather and climate impacts, and I'd be happy to go into some examples during the Q&A (question and answer).

These partnerships help us provide trusted and targeted climate information to users and give us feedback so we're constantly improving our science and services to meet the evolving needs of our stakeholders. One of my top priorities as NOAA Administrator is to enhance NOAA's role as the authoritative provider of climate products and services that can be applied through a diverse range of needs. It's my vision that by 2030 NOAA will work with its partners to build a climate-ready nation that gets information into the hands of decisionmakers, provides support for tribal, rural, and other underserved communities, and expands our resources for climate readiness, response, and resilience. This capability is reflected in the Department of Commerce Climate Action Plan in which NOAA leads the effort to foster and enhance the resilience of vulnerable communities.

At NOAA we recognize that climate adaptation and resilience are also opportunities to create jobs, spur economic growth, and pre-

vent avoidable damages to infrastructure. Since becoming Administrator, I've personally engaged with new and nontraditional partners, including the insurance sector, the American Medical Association, realtors, and civil engineers to let them know NOAA stands ready to assist with actionable information. I've heard both a willingness and urgency to incorporate forward-looking, authoritative climate information into their decisionmaking and business practices as climate change is a major risk to their bottom lines.

As part of the Department of Commerce, we can also help grow the burgeoning economic sector of commercial climate services to enable robust public-private partnerships, much like the successful $10 billion private weather enterprise that we know today. This new climate services sector, estimated to grow to a staggering annual value of $100 billion, will be built upon NOAA's credible data, research, modeling, and services. NOAA is an integral part of the whole-of-government effort to tackle the climate crisis, boost resilience, and promote economic growth.

In the next decade, our Nation must transition to a carbon-neutral economy if we're to stave off the worst impacts of climate change. At the same time, we must adapt to the impacts we cannot avoid. Achieving both will require making climate services accessible to all Americans to help them make informed decisions for their future. At NOAA, we are eager to work with communities and partners across the United States and to build a climate-ready nation. After all, if we prepare to fail, we are going to prepare to fail. Thank you.

[The prepared statement of Dr. Spinrad follows:]

WRITTEN STATEMENT OF
DR. RICHARD W. SPINRAD
UNDER SECRETARY OF COMMERCE FOR OCEANS AND ATMOSPHERE AND
NOAA ADMINISTRATOR

ON THE
FEDERAL CLIMATE ADAPTATION AND RESILIENCE FOR THE 21ST CENTURY

BEFORE THE
HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

1. INTRODUCTION

Chairwoman Johnson, Ranking Member Lucas, and Members of the Committee, thank you for the opportunity to testify today regarding the National Oceanic and Atmospheric Administration's (NOAA) efforts to adapt our facilities and operations to a changing climate, and to describe how we support the nation's preparedness and resilience.

2. NOAA'S UNIQUE ROLE IN ADDRESSING CLIMATE CHANGE

As part of Executive Order (E.O.) 14008, *Tackling the Climate Crisis at Home and Abroad*, President Biden directed all federal agencies to develop a *Climate Action Plan for Adaptation and Resilience* that would "describe steps the agency can take with regard to its facilities and operations to bolster adaptation and increase resilience to the impacts of climate change." The Department of Commerce (DOC) plan addresses the actions we are taking as a Department to ensure our facilities and properties are protected, but it also spells out actions that NOAA and our partner agencies are taking to extend our climate science, products, and services in collaboration with others. This approach recognizes and leverages NOAA's unique role and capabilities in support of nation-wide efforts to prepare for, adapt to, and respond to climate change and its impacts.

NOAA's efforts to enhance climate resilience in real assets extends beyond our own physical infrastructure to other federal and international efforts using NOAA climate products and services. In fact, NOAA's most impactful contribution to federal agency climate adaptation and resilience planning efforts is our ability to help others build resilience and prepare for the impacts of climate change. NOAA has extensive data, tools, and scientific programs that can support enhanced climate adaptation capabilities throughout the country with a range of partners. NOAA is already working with other federal agencies and international partners to prepare and build resilience, and, as we look to the future, NOAA is uniquely positioned to lead the way with science and expert consultation. This testimony will discuss both our efforts to make our own

federal operations more resilient to climate change and our significant activities to support a *Climate Ready Nation: that is, a thriving nation whose prosperity, health, safety, and continued growth benefit from a shared understanding of and collective action on climate change.*

3. NOAA'S MANDATE TO ENHANCE NATIONAL CLIMATE ADAPTATION AND RESILIENCE

NOAA's weather and climate offices and programs touch every U.S. community and affect every sector of our economy in every state and territory across the Nation. For more than 50 years, NOAA has invested steadily in observing, modeling, predicting, and understanding Earth's system. We understand that simply releasing data and/or tools to the public does not mean that they will necessarily be incorporated into decision making. Thus, we attempt to work directly with a wide range of users of our information to learn about their planning needs and to engage with them on the use of our products. We have a wealth of information, products and services to share. Our data feeds into NOAA's world-class climate and weather models, which provide Americans with daily, weekly, and monthly weather forecasts, and longer-term climate projections. We share this decision-ready information publicly and directly with users, including other federal agencies, through our many partnerships and "boots on the ground" activities across the country.

For example, NOAA's National Centers for Environmental Information (NCEI) is the nation's "scorekeeper" in terms of assessing high-impact weather and climate events by understanding their historical perspective. As part of its responsibility of monitoring and assessing the climate, NCEI tracks and evaluates climate events in the United States and globally that have great economic and societal impacts. NCEI has shown that, over the last four decades, the annual average of billion-dollar natural disaster events in the United States have quadrupled. In 2021, there were 20 weather/climate disaster events in the U.S. that each resulted in losses exceeding $1 billion. We know that human-caused global warming and natural climate variability combine to produce extreme weather and climate events that impact human welfare and natural systems. The drivers of these disasters and their costs are not solely due to climate change; we know, for example, that more people are more vulnerable now as they build, live, and work in harm's way.

Federal agencies, state and local governments, and the commercial sector rely on NOAA's science, observations, and data to help them meet their own missions and plan for their people. At NOAA, we advance scientific understanding with our in-house research and development capabilities and cooperative scientific partners, and design research to readily integrate into operations and to support applications. We collect long-term environmental observations, including key climate parameters, from *in situ* measurements, satellites, radar, atmospheric greenhouse gas sampling stations, ocean buoys, uncrewed systems, aircrafts, and ships. These observations provide essential inputs into NOAA's world-class Earth system models that, when

operated and analyzed by NOAA's premier scientists and elite forecasters, characterize our changing climate, with predictive capabilities on seasonal, annual, decadal, and centennial time scales.. In order to inform the congressionally mandated National Plan for Civil Earth Observations, NOAA works with other 12 U.S. Group on Earth Observations (USGEO) member agencies to coordinate and assess federal earth observations, conduct a biennial collection of agency satellite observation needs, and address data management principles, standardization, and implementation frameworks.

We regularly equip our interagency colleagues with climate data products and services they need to make informed decisions to minimize exposure to extreme weather and climate impacts. For example, NOAA's data on precipitation, extreme events, and sea level rise, along with other resources, underpin the Department of Defense (DoD) Climate Assessment Tool. This Tool enables branches of the Military and their installation personnel to deliver consistent exposure assessments and identify regions or installations for additional climate-related studies and is crucial in helping the DoD determine where best to apply resources to improve climate adaptation and resilience. NOAA's data, and staff expertise, played a pivotal role in DoD's work to produce a regionalized sea level and extreme water level database for 1,774 coastal and tidally-influenced military sites worldwide. These data assist decision makers in managing their risks in the context of plausible future sea level and extreme water levels. This study and database led to a new DoD requirement for all construction of U.S. military installations to take the risk of sea level rise into account, including that of Naval Station Norfolk, the Nation's largest naval station, located in a region increasingly prone to high-tide flooding events measured by NOAA's tide stations. NOAA continues to play a key role in DoD Coastal Assessment Regional Scenario Working Group (CARSWG) science advances and directives.

NOAA's climate data and products are also released publicly, including on NOAA's Climate.gov website, which provides continuously updated climate data, science, outlooks, and information accessible to non-technical audiences. Keeping these data and information accessible to individuals and community leaders is crucially important to NOAA. In October 2021, we released a redesign of climate.gov which added new features to make it easier to navigate and find the desired data and information. In addition, we understand that simply developing and releasing tools to the public does not assure their use; therefore, we work with the public to understand their needs and provide resources that they can use in their decision making. Our education, outreach, and extension efforts ensure communities are knowledgeable about and can use NOAA's climate science and tools. These on-the-ground efforts couple science and community-based organizations so that highly vulnerable and marginalized groups are reached and the next generation of climate resilience workers can be trained.

We translate our data into usable tools for our partners at all levels. For example, NCEI is continuing to develop increasingly tailored resources for assessing risk. In December 2021,

NCEI released an interactive NOAA risk mapping tool that provides detailed information on a location's susceptibility to weather and climate hazards that can lead to billion-dollar disasters—such as wildfires, floods, drought and heat waves, tornado outbreaks, and hurricanes. The tool expands upon FEMA's National Risk Index to provide a view of a location's risk for, and vulnerability to, single or multiple combinations of weather and climate hazards for every county and county-equivalent in all 50 states, and the District of Columbia. In addition, in January 2022, NCEI published climate summaries for every state, plus Puerto Rico and the U.S. Virgin Islands, that spell out recent local conditions and provide insights about the state's future climate outlook under different scenarios. For more specialized users, NOAA's extensive suite of online tailorable products and services, such as the Digital Coast, the Coastal Inundation Dashboard, and the National Integrated Drought and Information System, help decision makers reduce risk to life and property now and into the future. Federal agencies can use these NOAA tools to assess current and future weather- and climate-related risks relevant for their facilities and missions.

NOAA also has programs that provide hands-on, place-based assistance to state, local, and Indigenous leaders, underserved communities, and businesses across the country. This capability is reflected in the **first Priority Action identified in the *DOC Climate Action Plan*:** to *foster and enhance the resilience of vulnerable communities against the key climate risks of extreme heat, drought, wildfires, flooding, coastal inundation and impacts to fisheries.* The first priority action draws attention to the important work NOAA is doing with communities across the United States. These communities are experiencing complex challenges resulting from insufficient capacity and readiness to prepare for and manage the effects of a rapidly changing climate. In recognition of these challenges, NOAA works to ensure that these communities, especially the more vulnerable and underserved, have access to accurate weather and climate information and, increasingly, that local networks of partners and experts work collaboratively to make decisions that expand opportunities to adapt to the impacts of climate change. Our Regional Climate Centers, Sea Grant Colleges, Regional Integrated Sciences and Assessments (RISA) program, Regional Climate Service Directors, Fisheries Science Centers, and more, build and leverage trusted relationships to identify what users need, and provide actionable support. NOAA's National Integrated Drought Information Systems has brought together multi-agency, tribal, and academic partnerships to work with its 8 regional hubs to develop Drought Early Warning Systems and bolster regional, state and local resilience to drought. NOAA co-leads the National Climate Task Force's Coastal Resilience Interagency Working Group. It also works directly with states and local communities through our Coastal Zone Management Program, National Sea Grant College Program, Community-based Habitat Restoration Program, Office of National Marine Sanctuaries, Coral Reef Conservation Program, Digital Coast, and National Coastal Resilience Fund, among others, to restore coastal habitats such as marshes, mangroves, kelp forests, and coral reefs. And our 122 Weather Forecast Offices, 13 River Forecast Centers, and ten National Centers, including the Climate Prediction Center, answer questions about climate in

every U.S. county and territory. NOAA's 12,000 employees are deeply embedded in communities throughout the Nation, and are relied upon by the communities they serve.

NOAA engages with partners to plan for and adapt to climate change, by offering training, delivering fit-for-purpose information, implementing habitat restoration and nature-based approaches for resilience, and helping decision makers to prioritize adaptation measures. With over 100 staff throughout the country, the Office of Habitat Conservation's Restoration Center is a recognized center of excellence providing project design, permitting, construction, and monitoring expertise to local partners. Fisheries biologists, engineers, and other experts work directly with coastal communities to overcome technical hurdles and shape effective solutions that maximize resource benefits, the health of our living marine resources, and community resilience. NOAA will continue to work with partners on nature-based approaches to addressing climate change, including as consistent with the President's America the Beautiful Initiative.

In all aspects of our climate work, partnerships are crucial to success. Within and outside the federal government, NOAA convenes and works directly with our government partners to produce climate science and to support the agencies who need to use our science within their missions. For example, under the Congressionally mandated U.S. Global Change Research Program (USGCRP), NOAA works with the other 12 USGCRP member agencies to produce the periodic National Climate Assessment. NOAA also co-leads multiple interagency working groups focused on global climate change and climate science, adaptation and resilience, international collaboration, climate and human health, sustained assessments, and the social sciences of climate and global change. For instance, NOAA's National Integrated Heat Health Information System (NIHHIS) program is co-leading the National Climate Task Force's (NCTF) Extreme Heat Resilience Interagency Working Group to build a coordinated whole of government policy and response to extreme heat impacts which are projected to increase due to climate change. NIHHIS is hosting a national meeting in April to convene government and non-government stakeholders to elevate the conversation on extreme heat preparedness and developing heat resilient communities. Additionally, released in February 2022, NOAA led development of an interagency Sea Level Rise Technical Report, providing the most up-to-date sea level rise projections available for the United States. The Technical Report is the latest product of the Interagency Sea Level Rise and Coastal Flood Hazard and Tool Task Force and provides data critical to adaptation planning across sectors.

The impact of partnerships is reflected in the **second Priority Action identified in the *DOC Climate Action Plan:*** *to support the development of climate-ready infrastructure via the development of forward-looking building standards*. In this priority action, NOAA, jointly with DOC sister agency the National Institute of Standards and Technology (NIST), are committed to working together to identify and utilize appropriate climate data for application in building standards. In this effort, NOAA will identify existing climate data and projections, and, where

needed, develop new information to inform federal and non-federal bodies to develop standards, building codes, and guidelines that account for increasingly extreme weather events and other climate change challenges. This information will be crucial as NIST continues to engage with its stakeholders in the building science community.

This work is already underway. In November 2021, NOAA's Climate Program Office announced a new partnership with the University of Maryland (UMD) Center for Technology and Systems Management and the American Society of Civil Engineers (ASCE) to accelerate the development of climate-smart engineering codes and standards. This partnership is especially impactful as the vast majority of building codes in the United States and abroad rely on consensus guidance provided by ASCE, the nation's oldest engineering society. This collaboration will advance the use of NOAA-produced climate science and understanding within engineering practice for the design and construction of climate-resilient infrastructure, through developing and updating ASCE codes and standards.

NOAA is also playing a leadership role in implementation of the Federal Flood Risk Management Standard. As a member of the NCTF's Flood Resilience Interagency Working Group, NOAA co-chairs and provides input to the Federal Flood Risk Management Standard Science Subgroup, focused on updating the standard's Climate-Informed Science Approach to determining future flood hazards with the latest science guidance and developing tools and resources for agency implementation of the standard. This critical work will ensure federal investments are resilient to current and future flood hazards, reducing the devastating impacts of flooding on the nation's communities while providing dramatic savings over the long-term and ensuring uninterrupted public services.

NOAA also provides climate science subject matter expertise to the FEMA Technical Mapping Advisory Council, a federal advisory committee established to review and make recommendations to FEMA on matters related to the national flood mapping program. Homeowners, businesses, developers, real estate investors, insurers, and mortgage lenders all depend on flood maps to understand risk; it is critical to have the latest climate science informing this national program. NOAA and other agency partners are ensuring that both the work of the FEMA Technical Mapping Advisory Council and the Federal Flood Risk Management Standard are underpinned by the best available, actionable climate science

Finally, the international community has long looked to NOAA as a leader in climate research, early warning for risk management, adaptation, and resilience. Many of the climate services capabilities around the world today have their roots in NOAA supported science and partnerships that date back to the early 1990s. For example, NOAA and our partners learned a lot about forecasting El Nino, a climate phenomenon, and applying this knowledge to managing its impacts on water resources and agriculture from our international engagements. In addition, the

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President's Emergency Plan for Adaptation and Resilience (PREPARE) is a great example of what NOAA and our USG partners can offer to our international partners to address the climate crisis, and the support we can provide our own public and private sector interests and investments abroad. This kind of program cuts across many of NOAA's climate capabilities, tools, and services, and can create transformative opportunities for many of our partners in vulnerable regions, such as the island nations. Given the complexity of the climate crisis and its implications for national security, international commerce, international development and humanitarian aid, and public health and safety, the U.S. has a vested interest in understanding related impacts, vulnerability and response strategies beyond our borders, and bolstering the technical, institutional and human capacity in parts of the world.

Overall, this work will enable both federal and non-federal stakeholders to make climate-informed decisions that will mitigate the impact of climate change on our Nation's infrastructure, and facilitate informed infrastructure investments.

Our ability to help inform climate adaptation and resilience efforts, both within and outside the federal government, is vast. And, the next decade is a critical time to address the climate crisis. We have a small window to shift to a carbon neutral economy and hold climate impacts in check. We have an urgent need and unique opportunity to advance climate services across the Nation.

As we look forward, in pursuit of a *Climate Ready Nation,* NOAA will continue to increase engagement with a range of decision makers, including federal and non-federal partners, to improve the usability of NOAA's science for a range of climate-relevant decisions; provide support for vulnerable communities; and develop new or improve existing products and services that support climate readiness, response, and resilience. With additional resources, NOAA is well-poised to scale up our services so that all communities, businesses, indigenous communities, states, and Federal agencies in the United States have access to our world-class climate information, tools, and services so they can make informed decisions about their future.

We are targeting investments to address climate risks and key impact areas, including floods, fire, drought, and extreme heat and to build resilience in marine and coastal regions, while prioritizing efforts that are responsive to societal needs for climate information and support. These include, but are not limited to, critical, imminent investments as directed by Congress in the Infrastructure Investment and Jobs Act. For example, there is approximately $500M for coastal and inland flood and inundation mapping and forecasting, and next-generation water modeling and prediction science; $100M for wildfire-related prediction, detection, observation, modeling, and information dissemination; and $80M to support research supercomputing infrastructure used to underpin weather and climate model development to improve drought, flood, and wildfire prediction, detection, and forecasting. Additionally, the Infrastructure Investment and Jobs Act includes $1.27B for coastal resilience and habitat conservation at

NOAA, including $492M in National Oceans and Coastal Security Fund grants; $491M for habitat restoration; $207M for the Coastal Zone Management Program, and $77M for the National Estuarine Research Reserve Program. NOAA is also working with other agencies including the Department of Transportation to ensure their Infrastructure Investment and Jobs Act (IIJA) investments and projects are informed by NOAA's climate science and data, and the National Telecommunications and Information Administration (NTIA) to ensure their federal funding notices for IIJA-funded broadband expansion take into account climate change and weather extremes.

NOAA will specifically address inequalities in the provision of climate services to ensure that traditionally marginalized communities and groups are properly served. The magnitude of the challenges truly calls for building a workforce that includes physical and social scientists, modelers, science translators, educators, extension agents, tool developers, facilitators and trainers who reflect the diversity of our nation and who can *connect* with people across that nation, helping communities *apply* climate science as our knowledge grows. In this way, we are doing our part to support the whole-of-government effort to address the climate crisis, boost resilience, and promote economic growth. We are eager to work with communities across the United States, other federal agencies; businesses and the private sector, academia, and the public, to build a *Climate Ready Nation*, together.

4. NOAA'S ACTIONS TO BOLSTER ADAPTATION AND INCREASE RESILIENCE OF OUR SITES, FACILITIES, AND PROPERTY

NOAA's climate models project that climate-driven extreme events—including heavy precipitation events, extreme heat (even in the ocean), drought, wildfires—will continue to become more frequent and severe this century.[1] We also are reaching a better understanding of smaller events that do not make the headlines, such as sunny day flooding and stalled coastal storms that also greatly impact coastal communities. These changing conditions significantly threaten lives, livelihoods, and property. They put our government institutions and economy at risk, from U.S. military readiness to the insurance industry, from agriculture to public health. Unless substantial large-scale action is taken to address these and other climate-related risks through both greenhouse gas emission reductions and adaptation measures, the impacts on human welfare and natural systems are likely to worsen.

As E.O.14008 referenced, with these increasing risks and impacts, the federal government expects to experience rising maintenance costs, new programmatic challenges, and increased

[1] USGCRP, 2018: *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II* [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 1515 pp. doi: 10.7930/NCA4.2018.

health and safety risks to personnel. Thus, climate adaptation is critically important to the functioning of our government and to society as a whole.

NOAA's current facilities portfolio (over 620 facilities) is intentionally distributed across the United States based on science and management mission needs. The geographical diversity of the portfolio exposes NOAA's facilities and infrastructure to the full range of weather and climate extremes.

NOAA's 2016 assessment study of our facilities' vulnerability to climate change found that most facilities and surrounding property access are either already experiencing, or will experience, risk of flooding due to increasingly heavy precipitation, while extreme heat will increase cooling loads and stresses on building HVAC systems. NOAA's many coastal facilities will continue to be affected by sea level rise, storm surge, and high winds associated with coastal storms and hurricanes, while facilities in the Southwest will continue to be threatened by wildfires, extreme heat, and drought conditions. Availability of water, fuel, and other utilities necessary for logistical support of land-based facilities, NOAA ships, and aircraft could put critical NOAA data collection missions at risk. Further, harsh conditions and the changing climate may impact NOAA's ability to maintain its facilities in Alaska, the Arctic, and in low lying areas along the east coast, for example. To assess these serious vulnerabilities, NOAA has begun to consider natural hazard resilience and climate adaptation in every stage of our strategic visioning and capital project planning.

NOAA is currently developing a strategic portfolio review to ensure facilities are aligned and capable of supporting critical missions nationwide. The analysis includes a review of facility vulnerabilities and resilience to the increasing risks of extreme weather events and the adverse effects of climate change such as sea level rise. This information will support the planning process as documented in the DOC's 2021 Federal Climate Adaptation Plan.

In addition, reduction of NOAA's carbon footprint will require planning and targeted investments. Asset scores of NOAA's current facilities provide valuable insight into a facility's energy efficiency. Carbon footprint reduction can be realized through the inclusion of: energy-efficient building systems, recapitalization of at-risk facilities (condition, location), a flexible work space model that promotes blending of an in-person and virtual workforce, and, when possible, co-location with other NOAA, government, industry, or academic partners' facilities.

NOAA will continue to evaluate climate vulnerabilities and adaptation strategies in our capital project planning processes (e.g., Business Case Analyses and Analyses of Alternatives). For at least a decade, major facility planning efforts have assessed resiliency and included related cost factors appropriate for the projects that were planned and/or executed. One example of such a project is the Ketchikan Homeport Recapitalization project in Alaska, which supports the

Administration's climate adaptation E.O.14008 and NOAA's core science mission objective. The floating pier will be designed to withstand rising sea levels due to climate change, and its reconstruction entails a significantly reduced carbon footprint with fewer piles than a traditional pier. LED lighting also adds to the environmentally conscious nature of the project. Another recent example of incorporating climate resistant adaptations into design and construction is the newly built Aircraft Operations Center (AOC) in Lakeland, Florida. This Center was built not only to withstand hurricanes, but to maintain critical operations during these high-impact weather events. Within weeks of moving into AOC, Hurricane Irma's track went right over the hangar. The building safely housed personnel, assets, and even provided shelter for local emergency management assets who were able to immediately resume operations when the hurricane passed. NOAA has and should continue to lead and set the example of incorporating all available climate adaptation technology into our facility design.

In addition to leveraging NOAA's data, planning efforts also consider other multifactorial risk data, when available, from other federal agencies, institutions, and the private sector, that take into consideration hurricanes, tornadoes, earthquakes, hail, wind, drought, floods, high daily precipitation, snowfall, wildfires, and extreme temperatures. Projects in areas with particularly high vulnerability also include an evaluation of specific natural hazard risks, such as Hurricane Impact Probability.

While there are numerous other criteria considered in planning efforts, resilience factors are essential to optimizing NOAA's operational performance, mission effectiveness, and the safety and health of our employees. Additionally, when evaluating locations for new or recapitalizing facility options, alternatives include appropriate cost factors for mitigation and adaptation to climate change. NOAA will also bolster criteria and integrate appropriate additional project costs to meet net-zero emissions performance standards set by the Administration.

5. SUMMARY

In accordance with the DOC Climate Action Plan, NOAA is working to ensure our federal operations are resilient to the impacts of climate change. At the same time, NOAA is working with a range of partners, including other federal agencies, state and local government leaders, indigenous communities, communities, private businesses, international partners, and the public, so that we can collectively, as a nation, bolster adaptation and boost resilience to the impacts of climate change.

Dr. Richard W. Spinrad

Under Secretary of Commerce for Oceans and Atmosphere & NOAA Administrator

Richard (Rick) W. Spinrad, Ph.D., was sworn in on June 22, 2021 as the Under Secretary of Commerce for Oceans and Atmosphere and the 11th NOAA Administrator. Dr. Spinrad is responsible for the strategic direction and oversight of the agency and its over 12,000 employees, including developing NOAA's portfolio of products and services to address the climate crisis, enhancing environmental sustainability and fostering economic development, and creating a more just, equitable, diverse, and inclusive NOAA workforce.

Most recently, Dr. Spinrad served as a Professor of Oceanography and Senior Adviser to the Vice President of Research at Oregon State University (OSU). He was also Vice President for Research at OSU from 2010-2014.

Dr. Spinrad served as NOAA's Chief Scientist under President Barack Obama from 2014 until 2016. He also led NOAA's Office of Oceanic and Atmospheric Research and National Ocean Service from 2003-2010. While at NOAA, Dr. Spinrad co-led the White House Committee that developed the nation's first set of ocean research priorities and oversaw the revamping of NOAA's research enterprise, including the development of the agency's Scientific Integrity policy.

Prior to initially joining NOAA, Dr. Spinrad held leadership positions at the U.S. Office of Naval Research and Oceanographer of the Navy, where he was awarded the Distinguished Civilian Service Award — the highest award given by the U.S. Navy to a civilian. He has held faculty appointments at OSU, the U.S. Naval Academy, and George Mason University; served as Executive Director at the Consortium for Oceanographic Research and Education; was President of Sea Tech, Inc.; and worked as a research scientist at OSU and the Bigelow Laboratory for Ocean Sciences. He also developed the National Ocean Sciences Bowl for high school students. In the international arena, Dr. Spinrad served as the U.S. permanent representative to the United Nations' Intergovernmental Oceanographic Commission from 2005-2009.

He is the recipient of Presidential Rank Awards from presidents George W. Bush and Barack H. Obama. Dr. Spinrad is past president of The Oceanography Society (TOS) and the Marine Technology Society. He is a Fellow of the American Meteorological Society, Marine Technology Society, TOS, and the Institute of Marine Engineering, Science and Technology (IMarEST), and an IMarEST Chartered Marine Scientist.

Dr. Spinrad received his B.A. in Earth and Planetary Sciences from The Johns Hopkins University, and his M.S. and Ph.D. in Oceanography from Oregon State University.

Chairwoman STEVENS. OK. With that, we'll hear from Ms. Kolb.

TESTIMONY OF MS. INGRID KOLB,
DIRECTOR, OFFICE OF MANAGEMENT,
AND CHIEF SUSTAINABILITY OFFICER,
DEPARTMENT OF ENERGY

Ms. KOLB. Good morning. Congresswoman Stevens, Ranking Member Lucas, and Members of the Committee, it is an honor to appear before you today to discuss the Department of Energy's approach to addressing the threat of climate change to our mission and the actions that we are taking to enhance climate adaptation and resilience.

The mission of the Department of Energy is to ensure America's security and prosperity by addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions. DOE understands its mission is being performed in an already-changing climate. Our sites, many of which are located in or near several of your districts, are already experiencing the impacts of climate change on our operations. DOE is committed to taking action to adapt and to respond to these threats by increasing our resilience.

In August 2021, Secretary Granholm issued the Department's Climate Adaptation and Resilience Plan, which supports the President's climate and sustainability goals for climate-resilient infrastructure and operations. The plan addresses the extreme weather events that have impacted the Department's operations already. So some examples include wildfire damage and the disruption to operations that have occurred at such sites as Los Alamos National Laboratory in New Mexico and the Lawrence Berkeley National Laboratory in California; extreme precipitation and flooding that have impacted DOE sites such as the Pantex Plant in Texas, our Nation's only nuclear weapons assembly and disassembly facility; coastal flooding that's impacted our coastal sites, including the Strategic Petroleum Reserve, which is in Texas and Louisiana.

So the key strategies in our plan for addressing these impacts include the following: First, the Department is assessing our climate vulnerabilities at each DOE site and will develop resilience plans by this September. We will leverage risk assessment planning tools and the latest climate science information through collaboration with our national laboratories, including Argonne National Laboratory, as well as other Federal agencies, including NOAA.

The Department will also enhance climate resilience by adopting solutions such as natural or physical barriers to protect facilities and equipment vulnerable to flooding, reinforcing assets vulnerable to wind and ice damage, reducing wildfire potential, and providing backup power generation to address power outages.

In addition to hardening our assets, the Department is implementing resilience measures such as increasing energy efficiency and reducing energy demand. To support the transition to climate-ready sites, DOE will leverage its extensive land resources to increase resilience using onsite, clean energy generation and, where possible, using our buying power to work with other Federal agencies to procure clean electricity to meet the Administration's climate goals.

To support commercialization and deployment of new and innovative clean energy technologies, DOE will use its sites as testbeds to demonstrate innovative, sustainable solutions for adoption and deployment at DOE sites and subsequent deployment to the public and private sectors. All of these efforts will be coordinated with DOE's new office, the Office of Energy Justice and Policy and Analysis, to promote energy and environmental justice and ensure we deliver the benefits of climate investments and climate resilience to disadvantaged communities.

In summary, the Department will incorporate climate adaptation and resilience goals and actions in our planning and operations. We will also act with urgency to ensure the resilience of our sites. And finally, we will engage and share our best practices with other Federal agencies and other stakeholders.

So thank you for the opportunity to participate today, and I'm happy to answer any questions you may have.

[The prepared statement of Ms. Kolb follows:]

Testimony of Director Ingrid Kolb
Office of Management
U.S. Department of Energy
U.S. House Committee on Science, Space, & Technology
Subcommittee on Investigations & Oversight
March 8, 2022

Chairwoman Johnson, Ranking Member Lucas, Chairman Foster, Ranking Member Obernolte, and Members of the Committee and Subcommittee, it is an honor to appear before you today to discuss the Department of Energy's ("the Department" or "DOE") approach to addressing the threat of climate change to the Department's mission and operations, and actions that the Department is taking to enhance climate adaptation and resilience.

INTRODUCTON

The mission of DOE is to ensure America's security and prosperity by addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions. DOE works on the frontiers of scientific understanding and technical innovation to address the impacts of climate change by researching, developing, demonstrating, and deploying innovative and promising sustainable and resilient clean energy technologies. DOE understands its mission is performed in an already changing climate. Our sites, many of which are in or near several of your districts, and our operations are already experiencing multi-million-dollar damages and adverse impacts from extreme weather events. The Fourth National Climate Assessment, released in 2018, reports that the Nation will increasingly experience more frequent, intense, and longer duration extreme weather events across all regions of the country.

DOE is committed to taking every available action to adapt and respond to these threats by increasing Departmental resilience to the impacts of climate change. The Department is implementing a cohesive, strategic approach with strong leadership from Secretary Granholm for managing risks across the entire range of Departmental activities. Our climate response strategy is informed by science, and the science tells us that the time for climate action is now. DOE is leading by example to achieve the President's mandate to both enhance resilience to climate change and to reduce greenhouse gas (GHG) emissions. We are doing this by setting ambitious goals, developing aggressive implementation plans, and acting with urgency to execute those plans.

Department's Climate Adaptation and Resilience Plan

Let me discuss our recently established Climate Adaptation and Resilience Plan. Sustaining DOE's mission in this changing environment is dependent on DOE's ability to successfully identify aspects of climate change likely to impact our mission, operations, and workforce, as well as our ability to respond strategically. In October 2021, the White House released the Department's Climate Adaptation and Resilience Plan (CARP), along with similar plans from other agencies. The Department's plan is informed by the best science and technical information to effectively translate our plan into actions. Climate change adaptation is a crucial component of a comprehensive Departmental response to climate change. DOE will – through its plan – develop approaches that ensure its mission, programs, policies, and operations remain effective for the American people in current and future climate conditions.

This plan supports the President's goals articulated in Executive Order 14008, *Tackling the Climate Crisis at Home and Abroad,* and Executive Order 14057, *Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability.* The goals include: achieve climate resilient infrastructure and operations; use carbon pollution-free electricity (CFE), acquire zero-emission vehicles (ZEV), and achieve a net-zero emissions building portfolio.

Before I highlight the various strategies that comprise the Department's 2021 CARP that address some of the Administration climate goals, let me briefly describe how climate change and extreme weather are already impacting the Department.

DOE'S CLIMATE VULNERABILITIES

The Department's review of available research and data indicates it is important to act now. Not only the climate science, but the Department's climate change and extreme weather experiences including infrastructure damage and impacts on operations, demonstrate the need to take actions. The DOE enterprise includes field locations in 40 states across the nation that may experience a range of climate hazards. A few examples include wildfires, extreme precipitation, and coastal flooding.

Wildfires: DOE sites in the southwest have encountered prolonged droughts coupled with extreme heat events and wildfires. For example, Los Alamos National Laboratory (LANL) in New Mexico, and Lawrence Berkeley National Laboratories (LBNL) in California have experienced fire damage or disruption to operations. The damage costs have been significant. For example, LANL experienced approximately $500 million in direct infrastructure damage and lost productivity resulting from two catastrophic wildfires: the Cerro Grande wildfire in 2000 and the Las Conchas wildfire in 2011. At LBNL, the cost of lost productivity from wildfires and from the associated Public Safety Power Shutdowns imposed by Pacific Gas and Electric (PG&E), the servicing utility, was approximately $8.5 million. These wildfire risks are projected to increase with climate change.

Extreme Precipitation: Extreme precipitation events are impacting DOE sites, such as the Pantex Plant in Texas, our nation's only nuclear weapons assembly and disassembly facility. Pantex has experienced extreme weather events including extreme flood events, resulting in nuclear facility damage and operations disruption. For example, in 2010, Pantex received over 11 inches of rain in a single day, overwhelming drainage systems on the site, and flooding critical facilities, with damages exceeding $60 million.

Coastal Flooding: DOE sites along the coast are being impacted by changes in extreme weather events, and rising sea level. DOE sites such as the Strategic Petroleum Reserve (SPR) in Texas and Louisiana have experienced severe flooding events. SPR received more than $52 million in additional funding over the period 2017 – 2020 for repairs to infrastructure damage from hurricanes. Projections show the combination of extreme rains, stronger hurricanes, and rising seas may result in more flooding and threaten SPR's statutory mission to maintain drawdown readiness to meet the nation's critical energy goals and provide access to the nation's oil reserves.

Many of the climate change and extreme weather impacts are not unique to DOE, but the Department does have some unique climate challenges associated with our mission. For example, DOE's research, development, demonstration, and deployment mission requires specialized facilities such as high-energy physics particle accelerators, and high-performance super computers. The strategic importance of these capabilities has grown and these capabilities are an essential pillar of America's national security, our national economic competitiveness, and our global leadership in science. However, these specialized facilities require significant energy and water resources and are vulnerable to increased risks from climate change.

In addition to climate impacts on infrastructure, the Department must also address the impact of climate change on our workforce. For example, extreme heat events may result in heat stress among employees required to work outdoors. This could impact worker health and safety and increase the number of lost work hours due to heat-related work stoppages. The changing threat profile will continue to impact our workers and surrounding communities on which we depend.

CLIMATE ADAPTATION AND RESILIENCE PLANNING STRATEGIES

To achieve the Administration's climate goals and address the challenges to DOE's mission, operations and workforce posed by climate change, Secretary Granholm issued the 2021 Climate Adaptation and Resilience Plan. The CARP comprises several adaptation strategies, including many actions that have both adaptation and mitigation co-benefits, including:

Assessing Climate Change Impacts and Vulnerabilities: DOE sites will conduct climate vulnerability assessments and develop resilience plans this fiscal year and update these documents at least every four years. DOE will leverage risk assessment planning tools, including those from DOE's Federal Energy Management Program. DOE will ensure access to the latest climate science information for conducting vulnerability assessments through collaboration with our national laboratories including Argonne National Laboratory (ANL), as well as other federal agencies including the National Oceanic and Atmospheric Administration (NOAA).

Enhancing Resilience: DOE will adapt to the changing climate and make resilience a cornerstone of our operations. Enhancing climate resilience means taking actions to reduce potential future losses by planning and preparing for climate hazards such as extreme temperatures, floods, drought, and wildfires. The Department will seize new opportunities, such as: implementing hardening (e.g., physical or operational actions) measures to protect energy systems and other critical infrastructure from climate change and extreme weather. Measures being adopted include adding natural or physical barriers to protect equipment vulnerable to flooding; reinforcing assets vulnerable to wind and ice damage; reducing wildfire potential; and providing backup power generation to address power outages.

Examples of these climate hardening actions include:

- Power Outages: Many of our facilities rely on offsite electric power providers and have no alternate source if power is lost. To address this, are undertaking actions to enhance their climate resiliency. For example, ANL is upgrading its high-voltage power supply and providing redundant power sources to the site to increase operational resiliency. The project also prepares ANL for increases in electrical load to meet new supercomputing efforts.

- Wildfires: DOE sites are susceptible to wildfires, and efforts are underway to reduce the potential for wildfires and associated damages.

    - For example, to address the wildfire risks, sites like LANL have implemented a vegetation management program, a comprehensive hazard analysis and planning capability, field monitoring teams and a state-of-the-art Emergency Operations Center with backup power and water.

    - DOE's Power Administrations, including Bonneville Power Administration (BPA) and Western Area Power Administration (WAPA) have also taken proactive measures to manage the fire threat to their transmission assets. Bonneville Power Administration developed and implemented its Wildfire Mitigation Plan which establishes BPA's proactive stance to the management of its transmission assets. The scope includes vegetation and asset management programs to reduce the flammability threat across more than 15,000 circuit miles of high-voltage transmission lines.

    - Other sites, such as LBNL have done extensive assessment and planning in response to Public Safety Power Shutoff events due to wildfires. These events result in multi-day electricity shutoffs by their utility service provider PG&E during fire prone weather events. The Lab has installed temporary diesel generation to provide backup power in the event of a Public Safety Power Shutoff event. In addition, the Lab has implemented electric load-shedding hardware and procedures to shed loads and reduce the size of required backup power solutions.

- Flooding: Coastal and inland flooding has damaged DOE assets and impacted operations. Examples of hardening actions to address these impacts include.

    - In response to flooding threats the SPR has completed actions to: (1) identify, evaluate, and consider raising or reinforcing at-risk buildings/site facilities; (2) increase recovery pump capabilities; (3) add diesel pumps as backups at intake structures to have a non-power drawdown option; and (4) replace old or poorly designed pumps to reduce the potential for overheating.

    - Pantex has pursued multiple adaptation response actions to enhance resilience to flooding and other threats, including: (1) multi-stage flood control drainage improvement projects; (2) development and implementation of a comprehensive vegetation management plan accompanied by specific prescribed burns; and (3) projects to increase weatherization and freeze protection of vulnerable facilities.

- Drought: In recognition of potential impacts of droughts on water supply and availability, DOE is pursuing multiple activities focused on conserving water resources. To promote water conservation, DOE will prioritize water management, meter water usage to increase efficiency efforts, and use alternative water sources. DOE is also assessing the impact of drought on power generation, including hydropower.

    - For example, the Power Administrations are assessing the impact of climate change on water availability for hydropower generation in the Columbia River Basin. BPA, U.S. Army Corps of Engineers, and U.S. Bureau of Reclamation monitor regional warming

and streamflow changes in the Basin are collaborating to develop a state-of-the-science climate change and hydrology datasets for long-term planning activities.

Energy Efficiency: In addition to hardening assets, the Department is implementing other resilience measures, including increasing energy efficiency and demand response programs. These measures can contribute to enhanced resilience by reducing electricity demand load; reducing equipment wear and tear and the likelihood of equipment failure: and reducing the potential for power outages. Increasing the energy efficiency of the Department's buildings will also maintain habitable indoor conditions for longer periods of time during power interruptions.

- For example, several DOE national laboratories are demonstrating approaches to achieve net-zero emission buildings. The demonstration projects will develop a common framework for addressing the net-zero challenge, and leverage best practices and lessons learned for the DOE complex and private sector to advance zero-emission deployment and leverage the adaptation co-benefits of reduced energy demand.

Leveraging DOE Land and Procurement Buying Power: To support the transition to climate-ready sites, DOE will leverage its extensive land resources to increase resilience using on-site Carbon Pollution-Free Electricity (CFE) generation. DOE will also work with other Federal agencies where possible to leverage Federal procurement and buying power to support the Administration's climate goals. These efforts will build upon DOE site efforts to deploy renewable energy and reduce vulnerabilities to central power outages. Site examples include:

- NREL's installation of solar photovoltaic (PV) and battery storage for new buildings as well as installation of the electrical configuration required for emergency backup power and microgrids for new facilities. NREL now produces approximately 20% of the electricity that it uses.

- LBNL's installation of a 200-kW (kilowatt) solar array at the Integrative Genomics Building, offsetting about 14% of the total annual building energy use.

- The Pantex Plant deployment of five wind turbines on 1,500 acres that generate more than 60% of Pantex's annual electricity need and provides enhanced resilience to power outages. This year, Pantex expects to complete another interconnection line from the wind turbines to one of the site's substations that will greatly increase the amount of wind energy Pantex can use.

- The Western Area Power Administration partnering with the Northern California Electric Power Consortium (i.e., LBNL, Lawrence Livermore National Laboratory (LLNL), Stanford Linear Accelerator Laboratory, and Sandia National Laboratories in California) to create a 50 MW (megawatt) solar power purchase contract.

DOE will also couple various innovative technologies to increase adaptation and mitigation, such as combining CFE systems with microgrids and storage to ensure backup capabilities when grid power outages occur.

Demonstrating Innovative Sustainability Solutions: DOE will use its sites as testbeds to pilot innovative climate adaptation and mitigation technologies that improve both grid and climate change resilience as well as reduce GHG emissions. These demonstration projects will involve the advancement of climate technologies with site-specific energy/water resilience components such as new microgrids, power delivery systems, microreactors, water reuse systems, and gray water systems for landscaping. For instance, EERE will use the National Renewable Energy Laboratory (NREL) as a testbed for electric vehicles with a goal of electrifying 100 percent of NREL's fleet within two years—contributing to both reductions in transportation fossil fuel use, as well as enhanced site resilience by leveraging electric vehicle battery storage as a backup power source. NREL will draft a report, using the information gathered from this pilot, to help other DOE sites and Federal agencies prepare for fleet electrification by understanding potential issues. The Waste Isolation Pilot Plant (WIPP) is working to convert all underground vehicles to be electric. This will provide a showcase for electric vehicle conversion for industrial vehicles, while simultaneously increasing underground air quality, worker safety, and operational efficiency, as well as potentially increasing resilience by leveraging the battery storage capacity for backup generation. WIPP will also investigate the possibility of electric long-haul trucks for its waste transportation fleet. Another example is that DOE's Energy Assurance for Critical Infrastructure program and SNL are looking to deploy a microgrid in collaboration with Kirtland Air Force Base.

DOE will pursue the resilient net-zero challenge with demonstration projects at sites with a variety of missions, geographical diversity, and different energy sources. The goal of this approach will be to develop and demonstrate innovative, regionally dependent carbon-neutral and climate resilient solutions at varying scales and operating conditions that result in adaptation and mitigation benefits. The demonstration projects will develop a common framework for addressing the net-zero challenge, leverage lessons learned and best practices, and expand opportunities for technology and information transfer across the DOE complex and private sector to advance zero-emission deployment in the marketplace. Transitioning to zero emissions, using technologies such as on-site distributed renewable energy generation as well as the use of more energy efficient equipment will not only reduce energy consumption and emissions, but also reduce impacts from climate change on energy demand and supply. NE is advancing technologies to improve the flexibility of nuclear plants, including small modular nuclear reactors and microreactors, and provide energy resources that contribute to enhanced adaptation and mitigation. Additionally, NETL will assess opportunities for climate technologies that could be deployed at their campuses and could hold on-site demonstrations for technology transfer.

Zero Emission Vehicles: DOE has begun the transition to zero-emission vehicles (ZEV), through increased ZEV fleet acquisition and installation of charging stations. Electric vehicles are part of an approach not only to decarbonize our transportation emissions, but also to enhance resilience. DOE can leverage these "batteries on wheels" through a bidirectional grid to provide backup power during power outages.

- For example, the NREL ZEV pilot program has a goal of electrifying its fleet within two years, contributing to both reductions in transportation fossil fuel use, as well as enhanced site resilience by leveraging electric vehicle battery storage as a backup power source. Information gathered from this pilot will help other DOE sites and Federal agencies prepare for fleet electrification and leverage co-benefits such as enhanced resilience by understanding potential issues.

Energy and Environmental Justice: In implementing our climate and adaptation actions outlined above, the Department will also advance equity and promote energy and environmental justice.

- For example, DOE has established a new office, the Office of Energy Justice Policy and Analysis, within the Office of Economic Diversity (ED) which will implement President Biden's Justice40 Initiative —a plan to deliver 40% of the overall benefits of climate investments to disadvantaged communities and inform equitable research, development, and deployment within the DOE. ED in collaboration with other DOE programs is assessing the feasibility of using DOE sites to assist disadvantaged communities and populations, in partnership with relevant stakeholders, including community organizations, minority serving institutions, and governmental authorities. The Department will identify communication strategies and assess existing opportunities for resources and internships for neighboring energy and environmental justice communities this year.

CHALLENGES

There are several challenges that I would like to briefly highlight that will need to be addressed along the Department's path forward to address the climate crisis -- some are unique to DOE while others are crosscutting at the federal, state, and local level. The challenges include:

- Down-scaled Climate Science Information – In characterizing future vulnerabilities to climate change at DOE locations, there is a need for down-scaled climate science information that is relevant at the local planning level and addresses the lifespan of the critical assets at potential risk. The Department is collaborating with other agencies such as NOAA to ensure that we have useful climate science information and understand the uncertainties associated with climate projections for developing effective resilience plans.

- Resilience Metrics – While GHG emission reductions are commonly used to measure mitigation progress, there are no standardized and commonly accepted metrics for measuring resilience or quantifying resilience improvements. In addition, there is no consensus regarding appropriate resilience performance targets.

- Cost-Benefit Methodology – There is also an absence of up-to-date cost-benefit methodology to adequately monetize the costs and benefits of resilience investments. Current methods tend to fully account for the costs of resilience investments but may undercount the benefits.

- Climate-Ready Clean Energy Technologies – Much of today's energy infrastructure was designed and deployed decades ago to operate under a different range of environmental conditions than experienced today. Technology innovations are needed to improve the resilience of traditional energy technologies and equipment, as well as reduce the costs of innovative energy technologies, such as battery storage.

SUMMARY

The Department will incorporate the climate adaptation and resilience goals and actions in our planning and operations. Furthermore, the Department will engage and share best practices with other Federal agencies through the National Climate Task Force and interagency working groups, and by joining or forging new collaborations with other agencies and stakeholders, as appropriate.

We have a responsibility to address the climate crisis and ensure we continue to perform our critically important mission. In addition, the Department has an essential role to play in assisting the nation in fighting climate change, reducing carbon emissions, and adapting to the impacts that may occur.

Thank you for the opportunity to be here today. I am happy to answer your questions.

INGRID ANN CHRISTNER KOLB - DIRECTOR, OFFICE OF MANAGEMENT

Ingrid Kolb was appointed Director of the Office of Management on December 1, 2005. As the Director she leads an organization comprised of nearly 230 employees with a budget of about $55 million. The Office of Management (MA) is the Department of Energy's (DOE) central management organization providing leadership in such mission critical areas as acquisition management, sustainability, real property management, and personal property management. Ms. Kolb also leads the Department's internal policy and requirements program which develops procedures and processes for DOE organizations and its contractors. In addition, MA manages the Department's Headquarters complex and provides administrative support to DOE's 7,000 personnel in the Washington, DC area. Ms. Kolb also serves as DOE's Chief Sustainability Officer and Chief FOIA Officer.

Previously, Ms. Kolb served as Deputy Director of the Office of Management when it was established in October 2005. She also served as the Chief of Staff to DOE's Associate Deputy Secretary. In that role, she was responsible for coordinating DOE's implementation of the President's Management Agenda and for cross-cutting management issues.

Prior to that, Ms. Kolb was the Chief of Staff to the Chief Financial Officer (CFO) at the U.S. Department of Homeland Security (DHS). In that capacity, she managed day-to-day operations of DHS's budget, financial, accounting and planning functions.

Before joining DHS, Ms. Kolb served at DOE as the Chief of Staff for the Office of Management, Budget and Evaluation/Chief Financial Officer (OMBE/CFO). She coordinated DOE's implementation of the President's Management Agenda. She also oversaw DOE's human resources, budget, financial management, performance management, and procurement programs.

Prior to joining DOE, Ms. Kolb was the Director, Training and Development Center, at the U.S. Department of Education (ED). She was responsible for instituting employee development programs to support accomplishment of ED's mission and strategic goals. She provided educational services to ED's 5,000 employees through four training centers located throughout the Nation. In 1997, Ms. Kolb was awarded the Deputy Under Secretary's Reinvention Award for implementing a comprehensive professional development program at ED.

Previously, Ms. Kolb served as the Acting Deputy Director for Demand Reduction at the Office of National Drug Control Policy. In this capacity, she coordinated the implementation of drug treatment and prevention strategies for the Federal government. She developed drug treatment and prevention policy and represented the United States in international fora on drug policy. Ms. Kolb was graduated from Sweet Briar College in 1979.

Chairwoman STEVENS. Excellent. And with that, we'll go to Dr. Carney.

TESTIMONY OF DR. JOEL CARNEY,
DEPUTY ASSOCIATE ADMINISTRATOR
FOR MISSION SUPPORT OPERATIONS,
MISSION SUPPORT DIRECTORATE,
AND CHIEF SUSTAINABILITY OFFICER,
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Dr. CARNEY. Thank you, and good morning. Chairwoman Stevens, Ranking Member Lucas, and Members of the Committee, thank you for the opportunity to appear today to discuss NASA's efforts to increase resilience while achieving its mission in the face of a changing climate.

Through the—through data collection, improving our predictive capabilities, reducing the impacts of air travel, and advanced infrastructure planning, climate is a central theme at NASA. These efforts will inform responses to global challenges with climate change now and into the future.

Along with the organizations represented on this panel, NASA is one of the leading Federal agencies assessing climate vulnerabilities. NASA's Earth science missions collect data on space, airborne, and ground-based platforms, which are used to better understand trends in climate and improve our predictive capabilities. NASA's aeronautics research missions focus on advanced aircraft technologies and operational approaches that can lead to climate change mitigation benefits for the global community, including greenhouse gas emission reductions through electric propulsion and other advanced systems. Both of these organizations are also integral pieces of our Nation's effort to improve the control of wildfires and their cascading impacts.

Whether we are improving the global understanding of climate and its impacts or planning for future missions, NASA is focused on climate. Central to NASA's interest in climate effects is the threat posed to its unique critical infrastructure portfolio. NASA's missions rely on the availability and resilience of its facilities and their underlying infrastructure. Approximately 2/3 of NASA's assets are located within 16 feet of mean sea level along America's coasts. Sea-level rise, extreme weather events, coastal and river flooding, heatwaves, and other changes have damaged and are projected to damage our centers in the future.

Since 2003, NASA expenditures for recovery hardening and stabilization against these risks are estimated at more than $1 billion. For example, NASA has spent over $200 million in the last 2 decades repairing damage at centers due to flooding alone. Shoreline restoration projects have been necessary to protect critical launch capabilities from beach erosion at the Kennedy Space Center in Florida and the Wallops Flight Facility in Virginia. In the last 5 years serious hurricanes have damaged rocket motor assembly and testing infrastructure at the Michoud Assembly Facility in Louisiana and the Stennis Space Center in Mississippi. These events highlight the risks to past and future missions. Infrastructure investment remains an essential part of the equation to provide safe and efficient sustainable facilities that can withstand the evolving

climate-related challenges and continue to support the success of NASA's missions in the future.

In 2010, NASA established the Climate Adaptation Science Investigators, known as CASI, located at the Goddard Institute for Space Studies in New York City. The CASI team has worked with national and international teams to develop models that can better track and predict future climate conditions.

In 2020, we engaged with the U.S. Department of Energy's National Renewable Energy Laboratory to study climate resilience at our NASA centers. NASA plans to complete the initial resiliency studies for all centers by 2025. These studies will inform our strategic infrastructure planning processes, which will help us better align climate change adaptation and resilience efforts to projected mission requirements.

NASA is both a consumer of climate science and a leading source of climate data and information. We contribute to the latest climate observations, research, models, and analyses, providing foundational and decisional knowledge in cooperation with many partners. NASA will continue its efforts to improve our capabilities in modeling and climate change and its impacts and share that data with the scientific community and other government agencies. These data products can enable better scenario planning and longer-range decisionmaking for Federal agencies and managers in a range of U.S. sectors, including insurance, agriculture, water resource management, to name a few.

In closing, NASA continues to drive advances in science, technology, aeronautics, and space exploration to enhance knowledge, education, innovation, economic vitality, and stewardship of the Earth. We are committed to using our advanced planning techniques afforded by these scientific advancements to protect its assets and capabilities from the growing challenges of climate extremes and climate-related changes posed to our environment.

I thank the Committee for this opportunity to testify before you today and look forward to the Q&A period. Thank you.

[The prepared statement of Dr. Carney follows:]

National Aeronautics and
Space Administration

Hold for Release Until
Presented by Witness

March 8, 2022

Committee on Science, Space, and Technology

U.S. House of Representatives

Statement of:
Dr. Joel R. Carney
Assistant Administrator
Office of Strategic Infrastructure

117th Congress

HOLD FOR RELEASE
UNTIL PRESENTED
BY WITNESS
March 8, 2022

Statement of

Dr. Joel R. Carney
Assistant Administrator
Office of Strategic Infrastructure
National Aeronautics and Space Administration

before the

Committee on Science, Space, and Technology
U.S. House of Representatives

Chairwoman Johnson, Ranking Member Lucas, and Members of the Committee, thank you for the opportunity to appear today to discuss NASA's efforts to increase resilience and adapt to the effects of climate change to ensure the Agency's complex, aspirational missions are executed with continued success. Climate variability and climate change present important challenges that must be responsibly and proactively managed to ensure continuity of NASA's mission objectives. NASA's climate adaptation and resiliency planning efforts address not only the Agency's vulnerabilities that present risk to its missions, assets, and operations, but also provide information and tools that will be available to help address similar challenges being faced across the Federal Government.

NASA is one of several Federal agencies that conducts Earth observation, research, and data analysis critical to assessing climate risks and vulnerabilities. From the vantage point of space, as well as using airborne and ground-based platforms, NASA Earth Science measures and provides openly available data and information on Earth's radiation budget, oceanic and atmospheric temperatures, sea level rise, greenhouse gases, air pollutants, precipitation, soil moisture, changes in land cover and land use, distributions of sea and land ice, and biological activity on land and oceans, among many other things. NASA undertakes this work with the full knowledge that key Agency facilities are imminently threatened by the changing climate and we will need to take our own science and data into account in developing Agency policies, strategies, infrastructure master plans, and partner engagements.

Climate Resilience Challenges to NASA Infrastructure

Approximately two-thirds of NASA assets, when measured by their replacement value, are located within 16 feet of mean sea level along America's coasts. Sea level rise, extreme weather events, coastal and river flooding, heat waves and other changes have damaged or are projected to damage our Centers in the future. Since 2003, NASA expenditures for recovery, hardening and stabilization against these risks are estimated to have exceeded $1 billion. For example, NASA has spent over $200 million over the past 20 years repairing damage at Centers due to flooding alone. Since 2017, it has been necessary to undertake repairs resulting from hurricanes at four NASA installations: Kennedy Space Center (KSC) in Florida, Johnson Space Center (JSC) in Texas, Stennis Space Center (SSC) in Mississippi, and the Michoud Assembly Facility (MAF) in Louisiana.

Since 2012, NASA has spent $85 million at the Wallops Flight Facility in Virginia and $39 million at the Kennedy Space Center (KSC) in Florida on shore restoration projects. In 2014, NASA completed construction of a 1.2-mile inland dune, 15 feet in height, and approximately 50 feet wide at the base, at KSC. More than 180,000 grass specimens were planted, by hand, over a period of two months for shoreline stabilization.

While NASA has invested in projects to repair and protect its Centers against climate risks, the Agency has also benefited from proactive climate risk analysis and broader planning efforts. NASA recognized in 2005 that regional climate variability could pose a risk to operations and missions and identified it as a risk within the Agency's management framework. Subsequent initiatives, such as risk assessment workshops held in 2007, confirmed that natural hazards could impact NASA Centers and their ability to execute mission activities. From 2009 to 2012, NASA held workshops at each Center that provided NASA asset stewards and operations managers an opportunity to develop a greater understanding of potential Center-level climate impacts over time.

From 2010 to 2016, NASA sponsored Climate Adaptation Science Investigators, known as CASI, from the Goddard Institute for Space Studies, to work on research projects linked to local climate change issues and challenges. CASI supported multiple government-wide initiatives, including working with our regional partners at the St. Johns River Water Management District and the Indian River Lagoon National Estuaries Program in Florida. Both partnerships are focused on analyzing sea level rise scenarios for KSC and the surrounding Indian River Lagoon estuary. Results suggest that sea level rise on the order of 0.4 m, which NASA scientists project for the contiguous U.S. as soon as mid-century, will inundate approximately 25% of KSC's current land area, converting extensive wetlands into open water.[1] Warming weather and less frequent and intense cold spells may also allow the expansion of mangrove forest into the region, displacing current high marsh habitats that are home to numerous species of special concern.

Knowing that rocket engine testing at SSC depends on surrounding forests to buffer the necessary testing noise and vibration, CASI scientists used a model to assess forest health based on growth and decline observations compared to climate and weather observations and predictive models. This approach, baselined with observed and verified measurements, helped SSC resource managers better understand the buffer zone's resilience to climate change, approximate future climate impacts, plan accordingly, and implement proactive adaptation strategies.

Through the CASI initiative, climate projection data was provided for and subsequently used by all NASA sites in infrastructure master planning and engineering studies, including a 2019 adaptation study at KSC that identified individual facilities and roads and bridges that would be impacted by sea level change. In 2021, NASA initiated a second round of CASI studies to support enhanced climate adaptation strategies throughout the agency.

NASA's Climate Action Plan, released October 7, 2021, responds to President Biden's Executive Order 14008: Tackling the Climate Crises at Home and Abroad. The Plan presents five priority adaptation actions:

- Ensuring Access to Space
- Integrate Climate Adaptation into Agency and Center Master Plans
- Integrate Climate Risks into Risk Analysis and Agency Resilience Planning
- Update Climate Modelling to Better Understand Agency Threats and Vulnerabilities
- Advance Aeronautics Research on Technologies and Processes that Reduce Contributors to Climate Change

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[1] NASA Kennedy Space Center Future Development Concept, 2012-2031.

NASA is working to secure our nation's access to space by ensuring the resiliency of its infrastructure, using lessons learned from past climate-related events that have impacted facilities and operations. Past studies and current initiatives are the basis for a resilience framework that will provide a process for identifying threats, vulnerabilities, and risks that may impact the Agency's mission and operations, including risks associated with climate change. In 2020, NASA engaged the U.S. Department of Energy's (DOE) National Renewable Energy Laboratory to study climate resilience at NASA Centers. NASA plans to complete the initial resiliency studies for all Centers by 2025.

NASA is developing an Agency Master Plan (AMP), which will provide a 20-year vision for physical infrastructure and real property assets, aligned with projected mission requirements. The AMP will provide a roadmap to support advanced facilities planning, including the future development and redevelopment of Agency facilities and land assets and will demonstrate NASA's commitment to integrating climate risk management and resiliency into all Agency management processes and tools. The AMP will be completed in FY 2023 and will provide a single, cohesive mission-driven strategy for infrastructure investment, divestment, and sustainment, while maintaining a long-term risk mitigation strategy. The AMP will promote sustainability actions to provide climate mitigation and adaptation benefits, such as green energy technology, bioretention systems, permeable pavers, and tree box systems that can help manage stormwater runoff.

NASA Science and Technology Research Informs Climate Adaptation and Resilience Efforts

NASA is both a consumer of climate science and a leading source of climate data and information through its provision of the latest climate observations, research, models, and analyses, providing foundational and decisional knowledge in cooperation with many partners. As such, NASA plays an important role in implementing the President's Emergency Plan for Adaptation and Resilience, also known as PREPARE. NASA leads and contributes to the latest climate observations, research, models, and analyses, providing foundational and decisional knowledge in cooperation with many partners. NASA's Science Mission Directorate influences the global climate science community by leading the development and operation of climate observing satellites for the nation and promoting principles of open-source science and data that foster more rapid progress in Earth system science. This not only provides fundamental knowledge about Earth system behavior and evolution, but also informs climate adaptation and mitigation. NASA is one of the few government agencies that generates climate projections at downscaled resolutions that are useful to support regional climate studies and adaptation efforts. NASA will use this climate change knowledge, working in concert with many partners, to assess exposure, identify vulnerabilities, and develop adaptation strategies to address climate risk.

Anticipating and responding to climate change requires an ongoing, iterative cycle of assessment, action, reassessment, learning, and response. Advancements in climate science, modeling, analysis, and data visualization will support more rigorous vulnerability assessments. NASA will continue to improve our capabilities in the modeling of climate change and its associated impacts, refining estimates of climate impacts as models evolve and sharing this data with the scientific community and other government agencies that also model climate change. These refined modeling outcomes can enable better scenario planning and longer-range decision making for managers in a range of U.S. sectors, including insurance, agriculture, water resource management, forest and land management, transportation, and aviation, among others.

NASA coordinates with numerous international, Federal, state, local, tribal, and territorial government partners, as well as non-governmental organizations (NGOs), educational institutions, and U.S. commercial companies, to provide U.S. leadership in developing and carrying out Earth observations and research that informs strategic climate adaptation. NASA participates in and leads international forums

like the Committee on Earth Observation Satellites and sponsors and engages extensively in formal interagency activities organized under the auspices of the National Science and Technology Council, most notably the Subcommittee on Global Change Research, the Subcommittee on Ocean Science and Technology, the U.S. Group on Earth Observations, and the Subcommittee on Resilience Science and Technology. NASA's most active Federal agency partners include the National Oceanic and Atmospheric Administration, U.S. Department of the Interior/U.S. Geological Survey, U.S. Department of Energy, U.S. Department of Agriculture, National Science Foundation, U.S. Environmental Protection Agency, and the U.S. Department of Defense. NASA is a co-founder and an active participant in the Inter-Agency Forum on Climate Risks, Impacts and Adaptation, which supports knowledge sharing across the Federal Government and many other participating organizations.

The innovative global observations that NASA brings to the nation and the world synergistically complement satellite and in-situ surface-based observations that many of NASA's interagency partners produce. NASA's observations can also be used to inform the models and decision support systems used by other agencies. NASA's Applied Sciences Program plays a particularly important role in connecting and applying NASA-developed observations, data, and model products to the products and services provided by other Federal agencies, NGOs, and others in their service to the American public and the world.

NASA's Earth Science research enables improved knowledge of the Earth system, including the natural and human-induced processes that drive it, the processes by which it responds to these drivers, and the responses as a function of time and space. This knowledge can be incorporated into climate projections which can be used for adaptation planning. A specific example is demonstrated by the Gravity Recovery and Climate Experiment (GRACE) and GRACE Follow-on mission data, which show the large-scale movement of surface and groundwater throughout the continental U.S. CASI uses NASA Earth Exchange (NEX) products to provide NASA Centers and their regions with long-term (decadal to century) projections for climate change adaptation planning. These projections are based on downscaled global climate model results for temperature, precipitation, humidity, and radiation under a range of greenhouse gas emission scenarios.

NASA also plays a critical role in developing the technology that will reduce the amount of greenhouse gases emitted during air travel. NASA's Aeronautics Research Mission Directorate (ARMD) explores aviation concepts and technologies, some of which support NASA climate resilience. ARMD's aviation concepts, combined with NASA Earth Science observational data, help the Agency and others to reduce vulnerability to extreme events and long-term climate change. ARMD's research and development of advanced aircraft technology and operations lead to climate change mitigation benefits for the global community, including greenhouse gas emission reductions through electric propulsion and other advanced propulsion systems, as well as advanced composites and vehicle configurations. NASA will collaborate with Federal partners, industry, and other stakeholders to develop and implement aviation solutions that enable climate adaptation, while supporting the aviation community's goal to aggressively reduce carbon dioxide emissions.

NASA's missions support the national aviation community and Federal, state, and local emergency response communities. These efforts will support improved preparation for, response to, and recovery from disasters through collaborative aviation research programs, which can, for example, result in improved control of wildfires and management of cascading impacts. NASA leads cooperative efforts on the Global Fire Emissions Database that allows for near real-time emissions estimates (https://www.globalfiredata.org). NASA's "Fire Earth Information System Pilot Project" and Agency projects like "Forecasting of Weather, Fire Behavior, and Smoke Impact for Improved Wildland Fire Decision Making" deliver online information products to users (https://maps.disasters.nasa.gov).

Conclusion

To ensure NASA's continued success and capability in driving advances in science, technology, aeronautics, and space exploration, the Agency must responsibly steward its infrastructure to support its current and future mission requirements. NASA is committed to protecting its assets and capabilities from the growing challenges of climate extremes and climate-related changes to our environment. NASA has prioritized investments to address these challenges and to ensure continued U.S. global leadership in Earth Systems Science. When complete, NASA intends to use its Agency Master Plan and Center resiliency studies to better position the Agency to anticipate and project the resources that will be required to ensure sustainable mission success. NASA will continue to apply its science, engineering, and technological expertise to provide data, information and tools that will be of value to its continued mission success, and to other Federal agencies and users across the nation and world as we meet the future together.

In conclusion, I thank the Committee for the opportunity to testify before you today. I would be happy to answer any questions that you may have.

Dr. Joel R. Carney

Assistant Administrator, Office of Strategic Infrastructure

Joel Carney is the assistant administrator for OSI, leading the NASA's Environmental Management Division (EMD), Logistics Management Division (LMD), Facilities and Real Estate Division (FRED), and the Space Environments Testing Management Office (SETMO). This team is comprised of 4000 employees across the nation, setting the foundation for NASA's mission success. In this role, Dr. Carney focuses on NASA's infrastructure challenges, working with Mission Directorates and NASA Centers to ensure mission-critical assets are safe, ready and reliable. He also leads NASA's posture on key administration priorities, like climate change, environmental sustainment and engagement with tribal nations. Under Carney's leadership, OSI is transforming to become more efficient and effective by incorporating innovative technologies, new and improved processes and developing a comprehensive asset strategy through the Agency Master Plan (AMP). Carney manages over 5,000 facilities and assets in NASA's portfolio and looks for opportunities to consolidate and revitalize NASA's infrastructure to meet its evolving technical requirements.

Dr. Carney joined NASA in February 2020 when he was appointed the Deputy Associate Administrator for Mission Support Operations for NASA's Mission Support Directorate (MSD). In his role, Dr. Carney led NASA's mission support community in finding solutions to operational challenges critical to mission success. Under his leadership, the Operations Office coordinated activities and operations at the NASA Headquarters Building and presided over agency responses and documentation in audits, directives, and partnerships. Dr. Carney was also charged with the management of agency infrastructure risk, operational transformation, and the ongoing development of an Agency Master Plan, which prioritizes NASA facilities based on mission requirements. Dr. Carney ensures agility, strategy, and readiness in supporting NASA's complex and evolving missions.

Prior to joining NASA, Dr. Carney was the Principal Technical Manager of the Research Development Test and Evaluation Department (Code R) at the Naval Surface Warfare Center Indian Head Division (NSWC IHD). He led a diverse group of 300 scientists, engineers, technicians, and support staff with the direction of providing both near and far term science and technology solutions to our Navy and Department of Defense. Technical projects ranged from basic and applied research to the lot acceptance and life cycle assessment of ordnance. The department is comprised of scientists and engineers who are world experts in detonation science, chemical synthesis, homemade explosive and improvised explosive device technology, optical science applications, ordnance dissection and machining, and non-destructive evaluation. Code R is also the Navy's center for chemical, biological, and radiological defense (CBRD).

Dr. Carney began his career at NSWC IHD in 2002 as a research scientist, leading efforts to apply high-speed optical diagnostics to combustion and detonation events. These efforts led to advances in our understanding of enhanced blast explosives, reactive materials, and combustion applications towards the defeat of weapons of mass destruction.

Dr. Carney earned his undergraduate degree in Chemistry from Albion College (Albion, MI) in 1995. He received his PhD in Physical Chemistry from Purdue University (West Lafayette, IN) in 2000 under the direction of Professor Timothy Zwier. He also worked as a post-doctoral fellow for Dr. Michael White in the Chemistry Department at Brookhaven National Laboratory (Department of Energy) in Long Island, NY, from 2000-2002. Dr. Carney resides in Southern Maryland with his wife and two children.

Chairwoman STEVENS. Thank you. And with that, we're going to hear from Mr. Gomez.

TESTIMONY OF MR. ALFREDO GOMEZ, DIRECTOR, NATURAL RESOURCES AND ENVIRONMENT, GOVERNMENT ACCOUNTABILITY OFFICE

Mr. GOMEZ. Chairwoman Stevens, Ranking Member Lucas, and Members of the Committee, good morning. I'm pleased to be here today to discuss GAO's work on Federal climate adaptation and resilience.

The rising number of natural disasters and increasing reliance on Federal assistance is the key source of Federal climate-related fiscal exposure. This issue has been on our high-risk list since February 2013. Enhancing climate resilience to help limit the Federal Government's fiscal exposure to climate change could reduce the need for far more costly steps in the future.

The Administration is taking some actions to implement recent climate-related executive orders, including the development of agency climate adaptation and resilience plans, which we've heard about from some of the witnesses. These plans describe steps agencies can take to bolster adaptation and increase resilience to the impacts of climate change. We are monitoring the implementation of these efforts.

Madam Chairwoman, you asked about best practices that agencies could adopt to identify climate vulnerabilities and incorporate climate risks into their ongoing planning and program implementation. My statement today will discuss the Disaster Resilience Framework, which GAO issued in October 2019 and several reports on climate resilience.

Congress and Federal agencies can improve Federal climate resilience planning and implementation by pursuing opportunities related to three guiding principles of the disaster resilience framework: information, integration, and incentives. For the first guiding principle of information, Congress and Federal agencies can improve Federal climate resilience by helping decisionmakers access information that is authoritative and understandable to identify climate risks and the impact of risk-reduction strategies. Our past work shows how improvements are necessary across the entire Federal Government and within specific programs. For example, the Federal Government needs a governmentwide approach for providing Federal, State, local, and private-sector decisionmakers with the best available climate-related information and assistance with translating climate-related data into accessible information.

For the second guiding principle of integration, Congress and Federal agencies can improve climate resilience planning and implementation by helping decisionmakers integrate analysis and planning into their actions. We have previously recommended many ways to reduce Federal fiscal exposure by better coordinating and directing Federal climate resilience efforts toward common goals and developing a strategic approach for targeting Federal resources. Currently, the Federal Government makes ad hoc investments and does not have a strategy for prioritizing projects that could have the most impact. For example, in June 2019 we recommended that the military departments update criteria for instal-

lation master planning to incorporate climate risk and that DOD (Department of Defense) issue guidance on incorporating climate projections into installation master planning and facilities project designs.

For the third guiding principle of incentives, Congress and Federal agencies can improve Federal climate resilience by making long-term risk-reduction investments more viable and attractive among competing priorities. Federal incentives could also encourage risk-reduction investments in State and local infrastructure projects. In a GAO report from last year, we provided several options to enhance the climate resilience of federally funded roads. Specifically, we identified and analyzed several policy options such as expanded Federal grants or additional funding requirements to incentivize States and localities to enhance the climate resilience of federally funded roads and reduce Federal fiscal exposure.

In summary, investments in adaptation and disaster resilience are a promising avenue to address Federal fiscal exposure because such investments offer the opportunity to reduce the overall impact of disasters. We're also monitoring ongoing efforts to improve the integration of Federal climate resilience activities, and we will report on these activities as part of next year's high-risk list report.

Madam Chairwoman, Ranking Member Lucas, and Members of the Committee, this completes my prepared statement. I'd be pleased to respond to questions.

[The prepared statement of Mr. Gomez follows:]

United States Government Accountability Office

Testimony

Before the Committee on Science, Space, and Technology, House of Representatives

For Release on Delivery
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CLIMATE RESILIENCE

Opportunities to Improve Federal Planning and Implementation

Statement of J. Alfredo Gomez, Director, Natural Resources and Environment

GAO-22-105688

GAO Highlights

Highlights of GAO-21-105688, a testimony before the Committee on Science, Space, and Technology, House of Representatives

Why GAO Did This Study

The increasing number of natural disasters in the U.S. and reliance on federal assistance to address them are sources of federal climate-related fiscal exposure. *Limiting the Federal Government's Fiscal Exposure by Better Managing Climate Change Risks* has been on GAO's High-Risk List since 2013, in part because of the increasing costs of federal disaster response and recovery efforts. For example, from fiscal years 2015 through 2021, select appropriations for disaster assistance totaled $315 billion.

GAO has previously found that enhancing climate resilience could help limit future costs. Enhancing climate resilience means taking actions to reduce potential future losses by planning and preparing for potential climate hazards. Agencies have taken some actions, including in the areas of climate resilience planning.

This testimony focuses on how Congress and federal agencies can improve climate resilience planning and implementation by applying principles of GAO's *Disaster Resilience Framework*. This testimony is based on findings and methodologies of GAO reports on climate resilience from May 2011 through September 2021.

What GAO Recommends

Since 2003, GAO has made 84 recommendations and suggested six matters for congressional consideration related to enhancing climate resilience and limiting the federal government's fiscal exposure to climate change. As of March 2022, 31 recommendations are not yet implemented.

View GAO-21-105688. For more information, contact Alfredo Gomez at (202) 512-3841 or GomezJ@gao.gov.

March 8, 2022

CLIMATE RESILIENCE

Opportunities to Improve Federal Planning and Implementation

What GAO Found

Disaster costs are projected to increase as certain extreme weather events become more frequent and intense due to climate change, as observed and projected by the U.S. Global Change Research Program and the National Academies of Sciences, Engineering, and Medicine. GAO's Disaster Resilience Framework can serve as a guide for analyzing federal action to facilitate and promote resilience to natural disasters and the effects of climate change. The framework is organized around three guiding principles—information, integration, and incentives (see figure)—that can help Congress and federal agencies improve federal climate resilience planning and implementation.

Figure 1: GAO's *Disaster Resilience Framework* Principles

Source: GAO-21-275SP | GAO-22-105688

Information. Congress and federal agencies can help decision makers access climate information that is authoritative and understandable. For example, in November 2015, GAO reported that the federal government needs a government-wide approach for providing decision makers with authoritative climate information. GAO recommended that the Executive Office of the President (EOP) designate a federal entity to develop and update such information and designate a federal entity to create a national climate information system. EOP neither agreed nor disagreed with the recommendations and had not implemented them as of March 2022.

Integration. Congress and federal agencies can help decision makers integrate analysis and planning to take coherent and coordinated resilience actions. For example, in March 2021, GAO reported that the Department of Energy did not have a department-wide strategy to enhance the resilience of the electricity grid to the risks of climate change. GAO recommended that the department develop and implement such a strategy. The department agreed in principle with this recommendation, but its proposed actions do not fully address it.

Incentives. Congress and federal agencies can make risk-reduction investments more viable and attractive. For example, in September 2021, GAO identified a suite of policy options the Federal Highway Administration could take to incentivize states and localities to enhance the climate resilience of federally funded roads. GAO suggested that Congress direct the agency to implement one or more of these options, and to give it statutory authority to do so.

March 8, 2022

Chairwoman Johnson, Ranking Member Lucas, and Members of the Committee:

Thank you for the opportunity to discuss our work on climate resilience and federal agency climate adaptation planning and implementation. The rising number of natural disasters and increasing reliance on federal assistance to address them is a key source of federal climate-related fiscal exposure. From fiscal years 2015 through 2021, select appropriations for disaster assistance totaled $315 billion.[1]

Disaster costs are projected to increase as certain extreme weather events become more frequent and intense due to climate change, as observed and projected by the U.S. Global Change Research Program and the National Academies of Sciences, Engineering, and Medicine. Calendar year 2021 was the seventh consecutive year in which the United States experienced 10 or more weather and climate disaster events, each costing more than $1 billion in overall damages. Over the past 5 years, the cost of such disasters in the United States has averaged almost $150 billion each year, according to the National Oceanic and Atmospheric Administration National Centers for Environmental Information.[2]

Limiting the Federal Government's Fiscal Exposure by Better Managing Climate Change Risks has been on GAO's High-Risk List since 2013, in part because of concerns about the increasing costs of disaster response

[1]This total includes $240 billion in select supplemental appropriations to federal agencies for disaster assistance and approximately $75 billion in annual appropriations to the Disaster Relief Fund for fiscal years 2015 through 2021. It does not include other annual appropriations to federal agencies for disaster assistance. Of the supplemental appropriations, $97 billion was included in supplemental appropriations acts that were enacted primarily in response to the COVID-19 pandemic.

[2]National Oceanic and Atmospheric Administration National Centers for Environmental Information, "U.S. Billion-Dollar Weather and Climate Disasters" (2022), accessed February 18, 2022, https://www.ncdc.noaa.gov/billions/. Note that these data are not direct costs to the federal government and are produced using a detailed methodology reflecting overall U.S. economic damages including insured and uninsured losses to residential, commercial, and government/municipal buildings.

and recovery efforts.[3] We identified five areas in which government-wide action is needed to reduce federal fiscal exposure to climate change, including, but not limited to, the federal government's roles as (1) insurer of property and crops; (2) provider of disaster aid; (3) owner or operator of infrastructure; (4) leader of a strategic plan to coordinate federal efforts; and (5) provider of data and technical assistance to decision makers.

Enhancing climate resilience to help limit the federal government's fiscal exposure to climate change could reduce the need for far more costly steps in the future.[4] Enhancing climate resilience means taking actions to reduce potential future losses by planning and preparing for potential climate hazards, such as extreme rainfall, sea level rise, and drought.[5] Since 2003, we have made 84 recommendations and suggested six matters for congressional consideration related to enhancing climate resilience and limiting the federal government's fiscal exposure to climate change. As of March 2022, 31 recommendations were not yet implemented.

The administration is taking some actions to implement recent climate-related executive orders, including, Executive Order 14008 on Tackling

[3]See GAO, *High Risk Series: An Update,* GAO-13-283 (Washington, D.C.: February 2013) and, *High Risk Series: Dedicated Leadership Needed to Address Limited Progress in Most High-Risk Areas,* GAO-21-119SP (Washington, D.C.: Mar. 2, 2021).

[4]For example, see, GAO, *Climate Change: Opportunities to Reduce Federal Fiscal Exposure,* GAO-19-625T (Washington, D.C.: June 2019); *Climate Change: Selected Governments Have Approached Adaptation through Laws and Long-Term Plans,* GAO-16-454 (Washington, D.C.: May 12, 2016); and National Research Council, *Adapting to the Impacts of Climate Change* (Washington, D.C.: 2010).

[5]The National Academies of Sciences, Engineering, and Medicine defines resilience as the ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events. We reported in May 2016 that two related sets of actions can enhance climate resilience by reducing risk. These are climate change adaptation and pre-disaster hazard mitigation. In general, the term "adaptation" is used by climate change professionals, and "pre-disaster hazard mitigation" is employed by the emergency management community, often to speak about the same thing: becoming better prepared for climate change impacts. Adaptation is defined as adjustments to natural or human systems in response to actual or expected climate change. Pre-disaster hazard mitigation refers to actions taken to reduce the loss of life and property by lessening the impacts of adverse events. It applies to all hazards, including terrorism and natural hazards such as health pandemics or weather-related disasters. In this report, we use the term "climate resilience" for consistency and to encompass both sets of actions as they relate to addressing climate risks. GAO, *Climate Resilience: A Strategic Investment Approach for High-Priority Projects Could Help Target Federal Resources,* GAO-20-127 (Washington, D.C.: Oct. 23, 2019).

the Climate Crisis at Home and Abroad, Executive Order 14030 on *Climate-Related Financial Risk*, and Executive Order 14057 on *Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability*, and we are monitoring implementation of these emerging efforts.[6] Executive Order 14008, signed January 27, 2021, states that the administration's policy is to deploy the full capacity of the federal government to combat climate change and implement a government-wide approach that increases resilience. The order directs agencies to publicly submit plans that describe steps they can take with regard to their facilities and operations to bolster adaptation and increase resilience to the impacts of climate change and submit annual progress reports.

Executive Orders 14030 and 14057 require agencies to consider and report on additional climate resilience activities. Specifically, Executive Order 14030 requires agencies to report on actions they are taking to integrate climate-related financial risk into their procurement processes. In addition, Executive Order 14057 requires agencies to develop, implement, and update their Climate Adaptation and Resilience Plans and to conduct climate adaptation analysis and planning for climate-informed financial and management decisions and program implementation. In October 2021, the White House announced the release of more than 20 of these Climate Adaptation and Resilience Plans and invited public comments.

We have reported that the federal government has primarily funded disaster resilience projects in the wake of disasters—when damages have already occurred and opportunities to pursue future risk reduction may conflict with the desire for immediate restoration of critical infrastructure.[7] In October 2019, we issued the Disaster Resilience Framework to serve as a guide for analysis of federal actions to facilitate and promote resilience to natural disasters and changes in the climate.[8] According to the *Disaster Resilience Framework*, investments in disaster

[6]Tackling the Climate Crisis at Home and Abroad, 86 Fed. Reg. 7619 (Feb. 1, 2021); *Climate-Related Financial Risk*, 86 Fed. Reg. 27967 (May 25, 2021); Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability, 86 Fed. Reg. 70935 (Dec. 13, 2021).

[7]See GAO, *Disaster Resilience Framework: Principles for Analyzing Federal Efforts to Facilitate and Promote Resilience to Natural Disasters*, GAO-20-100SP (Washington, D.C.: October 2019), and, for example, *Hurricane Sandy: An Investment Strategy Could Help the Federal Government Enhance National Resilience for Future Disasters*, GAO-15-515 (Washington, D.C.: July 30, 2015).

[8]GAO-20-100SP.

resilience are a promising avenue to address federal fiscal exposure because such investments offer the opportunity to reduce the overall impact of disasters.

The *Disaster Resilience Framework* is organized around three guiding principles: information, integration, and incentives (see fig. 1).

Figure 1: GAO's Disaster Resilience Framework Principles

Source: GAO-21-275SP | GAO-22-105688

Note: For more information on the Disaster Resilience Framework, see GAO-20-100SP.

These principles can be applied to any federal effort to help federal agencies and policymakers consider what types of actions to take if they seek to promote and facilitate disaster risk reduction. Specifically, agencies and the oversight community can apply the framework as a tool to identify and analyze options for incorporating climate risks into ongoing planning and program implementation.[9] Users of the *Disaster Resilience Framework* can consider its principles to analyze any type of existing federal effort or identify gaps in existing federal efforts.

My statement today focuses on how Congress and federal agencies can improve federal climate resilience planning and implementation by pursuing opportunities related to the three guiding principles of the

[9]The invitation for this testimony specifically asked about best practices that agencies could adopt to identify climate vulnerabilities and incorporate climate risks into their ongoing planning and program implementation. There is tremendous variability in program design and implementation across the federal government. The *Disaster Resilience Framework* can help agencies and the oversight community analyze opportunities to improve climate resilience using a consistent set of principles and questions that are flexible enough to apply to the diverse federal enterprise. The framework itself is not a "best practice" to be implemented, but a tool to identify and analyze the many ways to enhance the climate resilience of federal activities. Not all parts of the framework will be relevant for every federal effort; some of the principles or concepts are likely to be more relevant in the analysis of certain federal efforts than others.

Disaster Resilience Framework. My statement is based on the findings and methodologies of GAO reports on climate resilience from May 2011 through September 2021.

We conducted the work on which this statement is based in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

The three guiding principles of the Disaster Resilience Framework—information, integration, and incentives—can help inform the climate resilience planning efforts of federal agencies.

Guiding Principle: Information

Congress and federal agencies can improve federal climate resilience planning and implementation by helping decision makers access information that is authoritative and understandable to identify current and future risks and the impact of risk-reduction strategies. Our past work shows how improvements are necessary across the entire federal government and within specific programs.

For example, the federal government needs a government-wide approach for providing federal, state, local, and private sector decision makers with (1) the best available climate-related information, and (2) assistance with translating climate-related data into accessible information. As a result, we recommended in November 2015 that the Executive Office of the President

- designate a federal entity to develop and periodically update a set of authoritative climate observations and projections for use in federal decision-making, which other decision makers could also access; and
- designate a federal entity to create a national climate information system with defined roles for federal agencies and nonfederal entities with existing statutory authority.[10]

[10]GAO, *Climate Information: A National System Could Help Federal, State, Local, and Private Sector Decision Makers Use Climate Information,* GAO-16-37 (Washington, D.C.: Nov. 23, 2015).

The Executive Office of the President neither agreed nor disagreed with our recommendations and had not implemented them as of March 2022.

In addition, our past work has shown that the federal government needs a comprehensive approach to improve the resilience of the facilities it owns and operates and the land it manages. We have found that this approach involves the following actions:

- **Incorporate climate change resilience into agencies' infrastructure and facility planning processes.** For example, in April 2013, we reported that infrastructure such as the National Aeronautics and Space Administration centers are vulnerable to observed and projected climate change impacts, which vary due to geographic location (e.g., coastal centers are vulnerable to sea-level rise). We made several recommendations, including that the Executive Office of the President work with agencies to identify the best available climate-related information for infrastructure planning, and update this information over time.[11] The Executive Office of the President did not comment on this recommendation and it has not been implemented as of March 2022.
- **Account for climate change in National Environmental Policy Act analyses, and work with relevant professional associations to incorporate climate change information into structural design standards.** For example, the Department of Commerce should convene federal agencies to provide the best available forward-looking climate information to standards-developing organizations, as we recommended in November 2016.[12] The Department of Commerce neither agreed nor disagreed with this recommendation and had not implemented it as of March 2022.

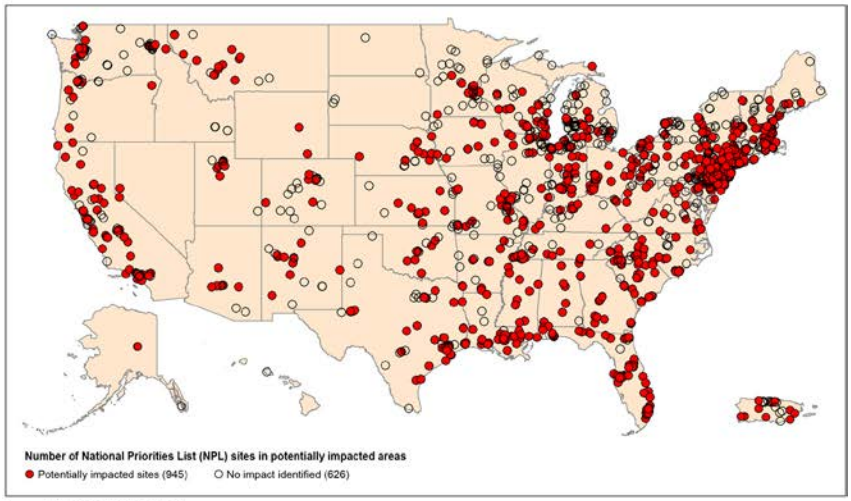
Our work on specific federal programs also shows the need for improvements in the provision and use of climate information. For example, in October 2019, we reported that available federal data suggested that about 60 percent (945 of 1,571) of all nonfederal Superfund National Priorities List (NPL) sites—which contains some of the most seriously contaminated sites—are located in areas vulnerable to

[11]GAO, *Climate Change: Future Federal Adaptation Efforts Could Better Support Local Infrastructure Decision Makers*, GAO-13-242 (Washington, D.C.: Apr. 12, 2013).

[12]GAO, *Climate Change: Improved Federal Coordination Could Facilitate Use of Forward-Looking Climate Information in Design Standards, Building Codes, and Certifications*, GAO-17-3 (Washington, D.C.: Nov. 30, 2016).

the impacts of climate change such as flooding, storm surge, wildfires, and sea level rise (see fig. 2).[13]

Figure 2: Nonfederal Superfund National Priority List Sites Vulnerable to Climate Change Impacts



Sources: GAO-21-555T | GAO-22-105688

Notes: This map includes nonfederal national priority list sites located in areas that may be impacted by flooding, storm surge, wildfires, or sea level rise. Nonfederal national priority list site data is as of March 2019. This map does not display all 1,571 active and deleted nonfederal NPL sites GAO analyzed, which also include six sites in American Samoa, the Federated States of Micronesia, Guam, the Northern Mariana Islands, and the U.S. Virgin Islands, though they are included in the counts above. Additional information on all sites GAO analyzed can be viewed at https://www.gao.gov/products/GAO-20-73. Storm surge data are not available for Alaska and Pacific islands other than Hawaii, wildfire data are not available outside the contiguous United States, and sea level rise data are not available for Alaska.

[13]GAO, *Superfund: EPA Should Take Additional Actions to Manage Risks from Climate Change*, GAO-20-73 (Washington, D.C.: Oct. 18, 2019).

We found that the Environmental Protection Agency (EPA) had taken some actions to manage risks at these sites but could do more to provide information to decision makers on the risks to nonfederal NPL sites. Specifically, we recommended that EPA's Director of the Office of Superfund Remediation and Technology Innovation provide direction on how to identify and use information on the potential impacts of climate change effects in risk assessments and risk response decisions at nonfederal NPL sites. At the time, EPA disagreed with this recommendation, but in June 2021, the agency issued a memorandum providing additional direction on how to identify and use climate-related information in risk assessments.[14]

Guiding Principle: Integration

Congress and federal agencies can improve federal climate resilience planning and implementation across the entire federal government and within specific programs by helping decision makers integrate analysis and planning to take coherent and coordinated resilience actions. We have previously recommended many ways to reduce federal fiscal exposure by better coordinating and directing federal climate resilience efforts toward common goals and developing a more strategic approach for targeting federal resources.[15] For example, we recommended that entities within the Executive Office of the President, including the Office of Management and Budget, do the following:

- Develop a strategic plan to guide the nation's efforts to adapt to climate change. This plan should (1) include clear priorities that reflect the full range of climate-related federal activities, and (2) establish clear roles, responsibilities, and working relationships among federal, state, and local governments, as we recommended in May 2011.[16]
- Use information on potential economic effects from climate change to help identify significant climate risks and craft appropriate federal responses, as we recommended in September 2017.[17]

[14]GAO-20-73.

[15]GAO-21-119SP.

[16]GAO, *Climate Change: Improvements Needed to Clarify National Priorities and Better Align Them with Federal Funding Decisions*, GAO-11-317 (Washington, D.C.: May 20, 2011).

[17]GAO, *Climate Change: Information on Potential Economic Effects Could Help Guide Federal Efforts to Reduce Fiscal Exposure*, GAO-17-720 (Washington, D.C.: Sept. 28, 2017).

- Provide information on fiscal exposures related to climate change to Congress in conjunction with future reports on climate change funding, as we recommended in April 2018.[18]

The Executive Office of the President, the Office of Management and Budget, and federal agencies have some related efforts under way in response to recent executive orders, but they have yet to fully implement these recommendations.

As we reported in our January 2021 High Risk update, Congressional action is necessary to enable the federal government to reduce its fiscal exposure to climate change risks through investment in climate resilience projects that help communities prepare for hazards such as sea level rise. Currently, the federal government makes ad hoc investments and does not have a strategy for prioritizing projects that could have the most impact.

For example, we have suggested that Congress consider the following actions:

- Establish a federal organizational arrangement to periodically identify and prioritize climate resilience projects for federal investment, as we suggested in October 2019.[19] Various types of entities that could lead such a federal effort include task forces, special councils, interagency offices, or interagency working groups led by agency and department heads or program-level staff.
- Establish a pilot program focusing on climate migration that has leadership from a defined federal organizational arrangement, as we suggested in July 2020.[20] This action is essential because no federal agency has the authority to lead federal assistance for climate migration, and therefore various agencies have provided support for climate migration efforts on an ad hoc basis As we reported in July 2020, such a pilot would identify and provide assistance to climate

[18]GAO, *Climate Change: Analysis of Reported Federal Funding,* GAO-18-223 (Washington, D.C.: Apr. 30, 2018).

[19]GAO-20-127.

[20]GAO, *Climate Change: A Climate Migration Pilot Program Could Enhance the Nation's Resilience and Reduce Federal Fiscal Exposure,* GAO-20-488 (Washington, D.C.: July 6, 2020).

migration projects for communities that express interest in relocation as a resilience strategy.[21]

Our past work has also identified the need to improve federal climate resilience planning within specific federal programs. For example, in June 2019 we found that the Department of Defense (DOD) generally did not consider climate projections in master planning for installations or in individual project designs because DOD lacked guidance on how to do so.[22] Some installations, like the Naval Station Norfolk, Virginia, have included climate considerations in their master plan because of disruptions in operations due to frequent flooding (see fig. 3).

Figure 3: Flooding at Naval Station Norfolk, Virginia

Source: GAO-19-453 | GAO-22-105688

[21]GAO-20-488.

[22]GAO, *Climate Resilience: DOD Needs to Assess Risk and Provide Guidance on Use of Climate Projections in Installation Master Plans and Facilities Designs*, GAO-19-453 (Washington, D.C.: June 12, 2019).

We made eight recommendations to help DOD improve its climate resilience planning. For example, we recommended that the military departments update criteria for installation master planning to require climate risk assessments, as well as plans to address those risks. We also recommended that DOD issue guidance on incorporating climate projections into installation master planning and facilities project designs.[23] DOD concurred with all eight of our recommendations and updated its guidance accordingly.

In addition, our past work has also identified the need to improve federal climate resilience planning within specific federal programs. For example, in March 2021, we found that the Department of Energy (DOE) has efforts under way to work with utilities and has initiated preliminary efforts to develop tools for resilience planning, but it does not have a plan to guide resilience planning efforts.[24] We made two recommendations, including that DOE establish a plan to guide the agency's efforts to develop tools for resilience planning.[25] DOE agreed in principle with this recommendation, but its proposed actions do not fully address it.

In another March 2021 report, we found that DOE identified climate change as a risk to energy infrastructure, including the electricity grid, but it did not have an overall strategy to guide its efforts to enhance grid resilience to climate change.[26] DOE has taken some actions to enhance grid resilience, such as establishing a partnership with utilities to plan for climate change, but could take additional actions. We recommended that DOE develop and implement a strategy on enhancing the resilience of the

[23]GAO-19-453.

[24]GAO, *Electricity Grid: Opportunities Exist for DOE to Better Support Utilities in Improving Resilience to Hurricanes*, GAO-21-274 (Washington, D.C.: Mar. 5, 2021).

[25]We also recommend that the Secretary of Energy should take steps to better leverage the National Laboratories' emerging grid resilience efforts and technologies by developing a formal mechanism to share this information with utilities. DOE agreed in principle with this recommendation, but its proposed actions do not fully address it.

[26]GAO, *Electricity Grid Resilience: Climate Change Is Expected to Have Far-reaching Effects and DOE and FERC Should Take Actions*, GAO-21-346 (Washington, D.C.: Mar. 5, 2021).

electricity grid to the risks of climate change.[27] DOE agreed with this recommendation and has taken some actions towards it.[28]

Guiding Principle: Incentives

Congress and federal agencies can improve federal climate resilience planning and implementation by making long-term, forward-looking risk-reduction investments more viable and attractive among competing priorities. For example, we have suggested Congress consider the following actions:

- Require that climate resilience be incorporated into the planning of all drinking water and wastewater projects that receive federal financial assistance, as we suggested in January 2020.[29]
- Provide direction to the Federal Highway Administration to implement one or more options to enhance the climate resilience of federally funded roads, as we suggested in September 2021.[30] Specifically, in our report, we identified and analyzed several policy options, such as expanded federal grants or additional funding requirements, to incentivize states and localities to enhance the climate resilience of federally funded roads and reduce federal fiscal exposure (see table 1). Implementing a suite of options that address many of the key principles and questions identified in the Disaster Resilience Framework would be the most effective approach, according to knowledgeable stakeholders and our analysis. However, Federal Highway Administration officials said they need additional authority from Congress to implement some of the options we identified and

[27]We also recommended that the Chairman of the Federal Energy Regulatory Commission should direct staff to take steps to identify and assess climate related risks to the electricity grid, and plan a response, including identifying actions to address the risks and enhance the resilience of the grid to climate change. The Federal Energy Regulatory Commission neither agreed nor disagreed with our recommendation.

[28]In their draft comments on GAO-21-346, DOE neither agreed nor disagreed with our recommendation. DOE agreed with our recommendation in a June 4, 2021 follow-up letter detailing the agency's plans to implement it.

[29]GAO, *Water Infrastructure: Technical Assistance and Climate Resilience Planning Could Help Utilities Prepare for Potential Climate Change Impacts*, GAO-20-24 (Washington, D.C.: Jan. 16, 2019).

[30]GAO, *Climate Resilience: Options to Enhance the Resilience of Federally Funded Roads and Reduce Fiscal Exposure*, GAO-21-436 (Washington, D.C.: Sept. 22, 2021). We also reported that each option we identified has strengths and limitations. For example, adding climate resilience requirements to formula grant programs could compel enhanced resilience, but make it more challenging for states to use federal highway funds.

that Congress should give the agency the authority in statute to ensure the agency implements Congress' preferred policy options.

Table 1: Options to Further Enhance the Climate Resilience of Federally Funded Roads

1.	Integrate climate resilience into Federal Highway Administration policy and guidance.
2.	Update design standards and building codes to account for climate resilience.
3.	Provide authoritative, actionable, forward-looking climate information.
4.	Add climate resilience funding eligibility requirements, conditions, or criteria to formula grant programs.
5.	Expand the availability of discretionary funding for climate resilience improvements.
6.	Alter the Emergency Relief (ER) program by providing incentives for, or conditioning funding on, pre-disaster resilience actions.
7.	Expand the availability of ER funding for post-disaster climate resilience improvements.
8.	Establish additional climate resilience planning or project requirements.
9.	Link climate resilience actions or requirements to incentives or penalties.
10.	Condition eligibility, funding, or project approval on compliance with climate resilience policy and guidance.

Source: GAO-21-436. | GAO-22-105688

We also made one recommendation in September 2021 that the Department of Transportation consider these options when prioritizing climate resilience actions under Executive Order 14008.[31] The Department of Transportation concurred with this recommendation.[32]

We have similar work underway that uses our Disaster Resilience Framework to analyze options to enhance climate resilience planning, management decision-making, and program implementation across the federal government. Specifically, we have work underway on options to enhance the climate resilience of a suite of U.S. Department of Agriculture programs, including the Climate Hubs and the federal crop insurance program. We also recently started work identifying federal policy options to help enhance the climate resilience of the Army Corps of Engineers infrastructure for flood risk management. These and future

[31]GAO-21-436.

[32]The Infrastructure Investment and Jobs Act (IIJA) directs the Secretary of Transportation to establish the PROTECT program to provide formula and discretionary grant funding to eligible recipients for transportation resilience improvements. Pub. L. No. 117-58, § 11405(a), 135 Stat. 429, 561 (codified at 23 U.S.C. § 176(a)-(b)). In addition, the act explicitly permits the use of FAHP funding provided through other programs, such as the Emergency Relief Program, for protective features, including those to mitigate the risk of recurring damage or the cost of future repair from extreme weather, flooding, and other natural disasters. Pub. L. No. 117-58, §§ 11105(2), 11106(3)(C), 11109(a)(1)(F) (codified respectively at 23 U.S.C. §§ 119(d)(2)(R), 125(d)(3), 133(b)(18)). Further, the IIJA provides an overarching definition of "resilience" applicable to the Federal-Aid Highway Program (FAHP). Pub. L. No. 117-58, § 11103(4) (codified at 23 U.S.C. § 101(a)(24)).

analyses can provide insights into the progress that federal agencies are making—and where additional action is needed. Further, as we stated in our September 2021 report on federally funded roads, this approach could help federal agencies, states, and other stakeholders work toward a common vision and ensure they consider a wide variety of opportunities to improve the climate resilience of federal programs and reduce federal fiscal exposure.

Chairwoman Johnson, Ranking Member Lucas, and Members of the Committee, this completes my prepared statement. I would be pleased to respond to any questions that you may have at this time.

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If you or your staff have any questions about this testimony, please contact Alfredo Gomez at 202-512-3841or gomezj@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this statement.

In addition to the individual named above, Joe Thompson (Assistant Director), Micah McMillan (Analyst-in-Charge), Holly Halifax, and Zoe Need made key contributions to this report. Other staff who made important contributions were Adrian Apodaca, Kevin Bray, Mark Braza, Janice Ceperich, Tara Congdon, Kathryn Godfrey, Susan Irving, Tracey King, Joe Maher, Celia Mendive, Tim Persons, Matt Voit, Jarrod West, and Kristy Williams.

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J. Alfredo Gómez serves as a Director in the Natural Resources and Environment team of the U.S. Government Accountability Office (GAO). He manages the team's work in environmental protection issues. His portfolio includes work in cleanup of hazardous substances, drinking and clean water issues, ecosystem restoration, pesticides, toxic chemicals, climate change, and EPA-wide management issues. Mr. Gómez has produced numerous reports and testimonies addressing a wide range of environmental, natural resource, agency management, and food safety issues. Mr. Gómez began his GAO career in the Chicago Regional Office in 1991, working on environmental protection issues. He left GAO to work for the Honolulu City Council where he audited local government agencies, and subsequently returned to GAO in 1998. Mr. Gómez holds a bachelor's degree in Chemical Engineering from Rice University and a master's degree in Public Policy Studies from the Harris School at the University of Chicago.

Chairwoman STEVENS. Great. OK, at this point, we're going to begin our first round of questions, and the Chair is going to recognize herself for five minutes.

So it's obvious and clear that, you know, the big picture of what the risks are and how they're threatening the agency's ability to achieve the various missions is documented. You know, Kolb talked about the fires, you know, we're getting a sense of the cost from NASA. And thank you, Mr. Gomez, for talking about the incentives.

I think the question, though, is around, you know, as you all are—at the agency level are working on your individual agency's resiliency strategy, sustainability strategies, how if it all are you coordinating through the Federal Government? Is there an interagency clearinghouse, or is this really taking place in isolated fashion? And, you know, Ms. Kolb, I'd certainly like to start with you, given your extensive background. I'm really quite fascinated that you spent time at DHS and now have this great post at DOE because we can sort of start to see the national security components that Mr. Gomez talked about. And he mentioned, you know, the military's involvement. But have you had interagency discussions at this point?

Ms. KOLB. Yes, absolutely. As a matter of fact, the Council on Environmental Quality (CEQ) has a Chief Sustainability Officers Council. We meet regularly. It's chaired by the government's Chief Sustainable—Sustainability Officer. And we talk about these very issues, how we're going to handle adaptation and resilience and sustainability as a government. And I really like the approach that CEQ is taking. You've heard some of my colleagues talk about a whole-of-government approach. And so there is quite a bit of coordination not just at our level but as levels as you go through the—you know, the government.

So, for example, on the climate adaptation and resilience plans that we were all required to prepare, those plans were developed by each agency, and then they were reviewed by panels with representatives from various agencies. So that gave all the agencies an opportunity to see what the others were doing so that they could then incorporate best practices into those. So it's been a very collaborative process, and I give CEQ high marks for the way that they have designed it.

Chairwoman STEVENS. Yes, that's great. And, Dr. Spinrad, I know with NOAA, we oftentimes just look to you for so much guidance on climate change and how to deal with it, but obviously, your testimony talking about how you're dealing with this as an agency. I was just wondering if you could share a little bit more about just the risks that your agency is facing as it pertains to, you know, the need for resilience.

Dr. SPINRAD. Yes, thank you, Chairwoman. The agency—NOAA has 620 facilities, buildings that we occupy around the country. And by virtue of our mission responsibilities, many of those are exposed to the threats of climate change. So what we have undertaken over the last couple of years is a rigorous regional footprint analysis for each of those facilities. It turns out that more than 1/3 of them are over 65 years old, so not only are they subject to the climate impacts but just the inherent vulnerabilities of being aging

buildings as well. We're finishing up those regional footprint studies. We've got two more to do in the mountain States and the Midwest over the summer. And subsequent to those, what we're doing is a business case analysis of where investments should be prioritized so we can optimize our capability to perform our mission in recognition of the impacts of climate change.

So I mentioned, for example, an example of what we're doing with our port facility in Ketchikan, Alaska. We recently moved our aircraft operations center where we fly our hurricane hunters from MacDill Air Force Base to Lakeland. In so doing, we constructed the facility, taking advantage of our understanding of what's going to happen to hurricane intensity in that part of the country. So through these analyses, through business case analysis, we're able to asset-by-asset make a determination of where we can apply resources most effectively.

Chairwoman STEVENS. Yes. And, Dr. Carney, you talked about the cost and obviously threw out a huge figure with $1 billion, but obviously costs come down, just hearing Dr. Spinrad, right, that the human capital cost, the time that it takes, the orientation. So just with the remaining time, I mean, best practices, ways in which you've found success, given your budget?

Dr. CARNEY. Right. It's a tough obstacle, and, you know, I think—I would describe ours as a methodical approach that balances a lot of different risks to our infrastructure. Dr. Spinrad mentioned the age of facilities. I'm sure DOE has the same issues, right? And so we have that natural vulnerability there, as well as I mentioned 2/3 of our facilities are at or near the coastlines that are vulnerable to flooding and some of the other coastal storms. So we really balance all that in terms of putting together a master plan that brings in all the aspects of cost and condition and mission criticality, in addition to our climate risks.

Chairwoman STEVENS. Fabulous. Well, thanks. You know, I'm going to yield back the time I don't have any more but—to myself. And as the Chair now recognizes Ranking Member Mr. Lucas for five minutes of questions.

Mr. LUCAS. Thank you, Madam Chairman.

Administrator Spinrad, it's good to see you again. And I'm sure you won't be shocked that my question today relates to a question I asked you in the Fiscal Year 2022 budget hearing we had back in September on commercial weather data program. Since we wrote the *Weather Act of 2017,* there have been a lot of developments in the weather data world, including new types of commercial products and services, as we face a future with many different environmental challenges. How does NOAA plan to evaluate and update the commercial weather data program?

Dr. SPINRAD. Yes, thank you for that question, Ranking Member Lucas. And yes, I'm glad we're following up on that because we've actually been able to undertake a number of additional initiatives. I'm trying to lean forward as hard as we can because we recognize it's a changing world. The world we knew 20 years ago where the government owned all of the assets and capabilities is changing fundamentally.

So just a few months ago I signed the agreement to continue a pilot project to access privately provided weather data as a dem-

onstration of how we can do the quality control on it, incorporate it into our models, and improve our forecasts. And in fact, as a result of that effort, we're getting something like 3,000 profiles a day of humidity in the atmosphere. I firmly believe that using a pilot such as the one I just described and working closely with the private sector, we can be much more aggressive about the incorporation of private commercial data into our weather products.

My concern of course is balancing that to make sure we have a sustainable capability that if the private sector, for whatever reason, chooses not to provide those data and information down the line, that we have ways of accommodating that, that we have a robust infrastructure if you will for incorporating commercial data into our public products and services.

Mr. LUCAS. Are there any new authorities you think that NOAA needs in the future for the success of the program?

Dr. SPINRAD. I think——

Mr. LUCAS. Is there anything else we need to do to enhance?

Dr. SPINRAD. Yes, I think—I basically say give me a bye on that until we see how this works with the current pilot projects. I think the answer to your question may very well be yes, there are some things that we need to improve on, but it is a bit early in the game right now to unequivocally say we need one of these and two of those in terms of authorities. I think we can come back to you after we've been able to demonstrate this project.

Mr. LUCAS. And I'm sure we'll discuss it.

Dr. SPINRAD. Very good, thank you.

Mr. LUCAS. Ms. Kolb, I want to shift my focus to you and DOE work force. In January of this year, the Department announced the launch of the Clean Energy Corps. Part of this announcement was that DOE plans to recruit an additional 1,000 employees. And I don't mean this in a combative way, but isn't solutions to climate change already baked into DOE's mission and everything you already do? And while you're thinking about that, what exactly is this new corps going to do that is unique?

Ms. KOLB. So in addition to the new team that we're going to be bringing on—and it's going to be about 1,000 new people—the reason we need these people is because we also received $62 billion in funding from the Congress in order to fund a number of very important initiatives. And so we need sufficient staff to make sure that that funding is spent properly and appropriately. That's one of the points that was made early on in this hearing, and that is extremely important to us. So the funding, you know, there will be competitions that are held, and we need experts who can analyze the applications that come in for the various funding and for the projects to make sure that we are funding projects that are worthwhile and are really going to make a difference in addressing climate change.

Mr. LUCAS. As hard as resources are, I just worry that trying to hire 1,000 new employees, and I worry maybe just for the sake of hiring a specific number of people is going to create a lot of bureaucratic headaches for the Department, massive might also be the word, and might distract from DOE's other work. Those are my concerns. So what is DOE's plan to ensure that these new positions

aren't duplicating other Federal efforts like NOAA or clashing with other existing agency efforts?

Ms. KOLB. So a lot of the work that we're going to be doing is around, for example, demonstration and research. So we're—our plan is to establish demonstration and research hubs, use our laboratories in many instances to demonstrate promising new technologies. There is substantial funding in the IIJA (Infrastructure Investment and Jobs Act), for example, for hydrogen research and testing, carbon capture and sequestration, advanced nuclear. These are very targeted. And so we are going to make sure that, again, we are spending this money responsibly and that we have experts who can help make that happen.

Mr. LUCAS. I very much appreciate that. And I suspect we, too, will revisit this issue in the future several times. With that, I yield back the balance of the time I don't have either, Madam Chair.

STAFF. Ms. Bonamici is recognized.

Ms. BONAMICI. Thank you so much to the Chair and Ranking Member, and thank you to the witnesses for your testimony and your expertise. Thank you, Mr. Lucas, for raising again the issue of our *Weather Research and Forecasting Innovation Act,* and I look forward to working with you, your question to Dr. Spinrad, let me know, and I'm happy to collaborate again.

Administrator Spinrad, it's very good to see you again. Our Federal agencies, in particular NOAA, are tasked with the critical responsibility of capturing and disseminating data to support adaptation and resilience. And, as you mentioned in—especially in your written testimony you expanded on the public and all levels of government rely on NOAA's science, observations, and data. So, Dr. Spinrad, how can NOAA improve the usability of and access to its climate data, research, and models across all levels of government?

Dr. SPINRAD. Thank you, Congresswoman Bonamici, and it's a pleasure to see you as well. NOAA is, I would say, always chasing the capability to get our information, products, and services into the hands of decisionmakers and users. And so what we have really pushed with respect to our activity in the last few months is engagement, building a whole set of new activities. We've done eight climate and equity roundtables with—all over the country with different communities. We've begun a series of industry listening sessions. And of course we have the capabilities in Sea Grant in our regional integrated sciences and assessments in our regional climate coordinators.

So the main thrust in getting the products out is, first of all, reaching the communities that need the help, especially the most vulnerable communities, but also not simply saying, OK, we heard you, now we're going to throw over the transom what we think you need but work in a co-development mode. And so this is where our efforts with tribes—and incidentally, we just brought on a full-time advisor for tribal consultation at NOAA specifically——

Ms. BONAMICI. Right.

Dr. SPINRAD [continuing]. For that reason. We have an equity advisor as well. It's about reaching out and co-developing products with those communities.

Ms. BONAMICI. Thank you. That's really helpful. How would improved consistency in climate data collection and sharing practices

across the Federal Government, how would that benefit Federal adaptation efforts?

Dr. SPINRAD. In short, I think that sort of leveling of the playing field if you will or standardization can best be demonstrated by what's happening with weather where there no longer is a question of, well, which weather product, which temperature prediction is most appropriate. This is something we feel very strongly about at NOAA, which is why we believe this authoritative—the role of being an authoritative source is critical. We work very closely with our partners, with DOE, with NASA, with all of the other Federal agencies. And I think having a clear definition of the roles and responsibilities in that regard can help ensure that there is no question about the authoritative nature of the data products and services.

Ms. BONAMICI. That's great. Thank you so much, Dr. Spinrad.

Director Kolb, in your testimony you highlighted a number of grid-hardening measures implemented at various DOE assets. And you specifically mentioned the resilience efforts that the Bonneville Power Administration has undertaken to prevent powerlines from igniting. We just had our first drought declaration in Oregon a few days ago, and we're obviously concerned of course about wildfires and extreme heat as we experienced last summer. To what extent are resilience efforts such as those implemented at Bonneville developed through engagement with grid operators and other nongovernmental experts? And to what extent is DOE sharing lessons learned with grid operators, facility managers, and other stakeholders on the efficiency of its grid resilience strategies?

Ms. KOLB. Well, thank you very much for that question. The Bonneville Power Administration, I have to say, has done an incredible job in really preparing for any threat of wildfire. They have a wildfire mitigation plan that they have executed. They are using vegetation management as a strategy. They are also replacing a lot of their equipment to make sure that it is fire-resistant, and they have put in extensive monitoring capacity so that they can detect a wildfire early on. They have done a lot of work with the Army Corps of Engineers, as well as the Bureau of Reclamation, to study the impact of drought. And, fortunately, there's no serious impact at this time, but they're very much staying on top of that. So they are working with these other agencies very closely and making sure that, you know, they're continuing to stay on top of the situation so that wildfires are not a threat. They also work with our other power marketing administrations. We also have the Western Power Marketing Administration that covers much of the Southwest. And so that relationship between Bonneville and Western Power is extremely important so Western Power has the benefit of the expertise from Bonneville.

Ms. BONAMICI. And thank you very much. And as Dr. Spinrad, a fellow Oregonian knows, the Bonneville Power Administration is located up in the Columbia Gorge. And the fires we've had over the last several years have just been devastating, so thank you for your work to prepare for those.

It looks like there's still time on the clock, but I believe it stopped for a bit, so I'm going to yield back the balance. Thank you, Madam Chair.

STAFF. Mr. Posey is recognized.

Mr. POSEY. I appreciate you holding this hearing, Chairwoman Stevens.

And I ask unanimous consent to include in the record Executive Order 14008: "Tackling the Climate Crisis at Home and Abroad."

Chairwoman STEVENS. So moved.

Mr. POSEY. Thank you. Dr. Spinrad, Ms. Kolb, and Dr. Carney, in section 103, part C, of the Executive order it states that appropriate Federal agencies that include in part NOAA and NASA should coordinate with the Secretary of Defense to develop and submit to the President within 120 days of the order an analysis of the security implications of climate change, a climate risk analysis that can be incorporated into modeling, simulation, wargaming, and other analysis. Has this analysis been completed and submitted to the President? And, beyond that, what role did each of your agencies contribute to the analyses, and how will your agencies' analyses be used to model, simulate, or otherwise assist wargames for the Department of Defense?

Dr. SPINRAD. I would be glad to jump in, sir. Thank you, Congressman, for that question. By way of a little color commentary, I spent at least half of my career working for the Department of the Navy, so I was encouraged when I saw that language in the executive order. And in fact DOD has moved quite aggressively. They have developed—our colleagues at DOD have developed a climate assessment tool to be applied to the national security assets. NOAA data are fully incorporated in that tool, and that is part of the product that DOD has prepared. Thank you.

Mr. POSEY. Thank you. Ms. Kolb?

Ms. KOLB. I am not personally familiar with the work that DOE may have performed on this effort, but more than likely our national laboratories, our nuclear security national laboratories that work very extensively with DOD may have been involved, but that is something that I can provide for—as a follow up.

Mr. POSEY. OK, thank you. Dr. Carney?

Dr. CARNEY. Yes, sir. Similarly, I'm not familiar with the detailed response to the President on this topic, but, again, we are in for, you know, sharing of data, open-source data, working with our colleagues here on the panel to get a consistent voice and a consistent set of data that we can help use across the whole Federal agency so we can definitely follow up on that progress down that path. Thank you.

Mr. POSEY. And I have submitted a request for that information to your agencies, so I'm sorry they didn't touch base with you on it.

Dr. Spinrad, in the same Executive order, section 216, states that NOAA will be one of the main agencies to elicit input from stakeholders in identifying strategies that will encourage broad participation in the goal of conserving 30 percent of our lands and waters by 2030. Since this goal has a deadline of only 8 years away, what are the strategies NOAA has identified to conserve 30 percent of our lands and waters?

Dr. SPINRAD. Yes, thank you. So there are a number of aspects of the America the Beautiful Initiative, one of which is getting a clear definition of what conservation means. And we've spent a lot

of time talking about that, especially in the context of an agency like NOAA where we're balancing conservation and environmental stewardship with economic development, so we want to make sure that definition is well in hand with respect to how we identify those plans.

We are also, across the agencies through the interagency mechanisms that we've got, identifying those areas that qualify for consideration under the 30 by 30 designation. And in NOAA, for example, one of our primary efforts is associated with the designation of natural marine sanctuaries. So this past summer we designated a new national marine sanctuary in Wisconsin. We also designate national estuary research reserves and have done that around the country as well. So for us it's using existing authorities to establish reserves and sanctuaries in the context of what the definition of conservation means.

Mr. POSEY. Thank you very much, Dr. Spinrad. I want to thank the witnesses. I see my time is expired. I yield back. Thank you.

STAFF. Mr. Bowman is recognized.

Mr. BOWMAN. Mr. Gomez, thank you for your testimony. You discussed the need for enhanced working relationships between Federal, State, and Local governments. In Westchester County in New York, which I represent, there's a group of local, county, and State officials called United Westchester that coordinates on storm planning and response efforts. They have been issuing and updating detailed recommendations on what local utilities need to do better to deal with extreme events like Hurricane Ida, for example. I'd like to ask what opportunities you see for not only better information flows in one direction but also for genuine collaboration between different levels of government on climate resilience. How can the Federal Government learn from what communities in Westchester and elsewhere are already doing, better understand their needs, and feed that information back into national strategy making? What can we in Congress do to build more capacity for this?

Mr. GOMEZ. Thank you for that question. And yes, you raise a really good point, that there is a need for continued Federal involvement to help State, local, tribal, private folks better understand what their risks are through information that's provided but also making sure that that information is translated, right, so that they can understand it.

You know, we do know of many partnerships that Federal agencies play with local communities. And you mentioned the utility area, so that is also an area where the Department of Energy has partnered up with utilities to make sure that they are building, for example, resilience to a changing climate.

But in our work, we—when we go out and talk to State, local, and tribal folks, they always say the need for more—better information from Federal agencies, and that is part of our disaster resilience framework as well is to make sure that we're providing the information that decisionmakers need not just at the Federal level but all levels of government.

Mr. BOWMAN. Mr. Gomez, as you know, this kind of collaboration is crucial for embedding equity and justice in our resilience efforts. In my district and around the country, community groups often work closely with universities and government agencies on environ-

mental justice issues, including NOAA. Dr. Spinrad, you spoke to this in your response to Representative Bonamici. Do you have anything to add here, given your agency's extensive work with local communities?

Dr. SPINRAD. Yes, thank you for that question. I referred to the climate and equity roundtables that we had conducted, each of which was focused on a particular concern, heat in the Southwest, flooding in the Northeast, and we made a special effort because it was about equity—that is to say roundtable discussions—to bring in clergy, community workers, local emergency managers. The outcome of this is we now have eight pilot projects that we are undertaking to demonstrate how we can deliver products and services more equitably and effectively for the communities that we began engaging with in these roundtables.

Mr. BOWMAN. I have a question for Ms. Kolb. Thank you, Ms. Kolb, for your testimony. I'm wondering if you could elaborate on how DOE thinks about the relationship between resilience and decarbonization strategies and how to integrate the two. At last week's IPCC (Intergovernmental Panel on Climate Change) report—as last week's IPCC report reminded us, if we fail to cut emissions much more quickly, it will be harder and harder to figure out how to adapt. So, for example, if we are going to invest in protecting our K to 12 students from climate disasters, I think we should be installing solar panels and heat pumps in public school facilities as part of the same effort. You gave several other examples in your testimony. Can you talk about how DOE is seeking out co-benefits between mitigation and adaptation?

Ms. KOLB. Well, absolutely. Thank you for this question. This is a great question because there are so many linkages between resilience and sustainability and those co-benefits that you talk about because the more we can reduce greenhouse gas emissions, the—you know, it just helps with our resilience efforts.

So at the Department of Energy of course, you know, we are committed to meeting the President's goals that he has set forth in the Executive order just last December. But there are three areas that I really want to highlight. The first one is making sure that we are using carbon pollution-free electricity. And at the Department of Energy we are committed to doing this by the year 2030, which is going to be quite a challenge. But we're going to do that through—you know, we're talking about solar panels, so onsite renewable energy is going to be an important piece of that. Also working with utilities to make sure that they are providing electricity that is sourced from clean energy sources. And then also an important part is making sure that we are reducing the amount of energy we need by making our facilities more energy-efficient, so that's really important.

Another piece has to do with zero-emission vehicles. The Department of Energy and all other energy—all other agencies are committed to making sure that we are moving to zero-emission vehicles. And for our light-duty vehicles, our goal is to accomplish that by the year 2027, which is just around the corner.

And then finally, we're focused on our buildings. Like some of my colleagues have already mentioned, at the Department of Energy we have a lot of very old structures. They are not energy-efficient,

and so we need to make sure that our new facilities that we construct are energy-efficient and do a lot of work to renovate the old buildings to make sure that they come up to standard. So those are just some of the things that we're doing. And also through, you know, the funding that has been provided through the IIJA, we will be helping the communities across the Nation achieve these same sort of goals. So thank you for your question.

Mr. BOWMAN. Thank you. I yield back my time. Thank you.

STAFF. Mr. Weber is recognized.

Mr. WEBER. Thank you. Ms. Kolb, these questions will be for you. You say that—or can you talk about—you talked about retrofitting facilities versus building new facilities, and you say climate risks should be incorporated into both but it's going to be different challenges to adapt existing buildings compared to factoring in risks as you build new ones. So my question is is there—has there been a study done on that difference?

Ms. KOLB. I'm not aware of a specific study, but, for example, if you can, you know, start from scratch, you can use the latest building codes, which is what we are doing, and make sure that you are constructing an energy-efficient building, zero-emissions building. But you if you have an old building, it's much harder to retrofit. You can change out the HVAC (heating, ventilation, and air conditioning), you can change out, you know, the underlying utilities, but it is much more expensive to have to renovate an older building. I mean, that's just——

Mr. WEBER. Well, you know, I was an air-conditioning contractor for 35 years, so the cost of property, the cost of the building, and the cost of everything, that all has to be decided, and I would think—I would hope there would be a study done as to the existing facilities and what that would look like.

I'm going to change to another question. You said carbon-free electricity by 2030.

Ms. KOLB. Yes.

Mr. WEBER. Are you aware of last year Texas went through a winter storm in February that was the coldest from the Gulf Coast we'd seen in probably hundreds and hundreds of years? I've lived there 68 years and had never seen it. I just look hundreds of years old. But do we take into account any of the effect—when you talk about carbon-free electricity, you talk about windmills and solar panels, windmills failed in Texas. They froze up, they did things. And it's 20 percent of Texas' electricity. As you know, Texas is the No. 1 windmill State, we're No. 2 in solar panels. California has edged us out in solar panels. When you talk about going carbon-free electricity by 2030, is there any information—any—another study done on how that affects the actual energy market itself in the economy?

Ms. KOLB. I'm sure studies have been done. I am not familiar with them. But at the Department of Energy it's not just renewable energy but also clean energy sources. And that's why we're working very hard on, for example, microreactors. Our Idaho National Laboratory, which is our nuclear laboratory, is focused on those, as well as small modular nuclear reactors. Our National Energy Technology Laboratory in West Virginia, Pennsylvania, and Oregon is busily working on carbon capture and sequestration technologies.

So those are all other ways that we are going to be able to meet our goal of carbon- and pollution-free electricity.

Mr. WEBER. Yes. Well, I have the largest carbon capture sequestration storage facility in my district over at Port Arthur, Texas. When you talk about windmills and stuff, you're aware of all the amount of rare earth metals and stuff that goes into the production of windmills. What's the extent—the expected life of a windmill? Do you know?

Ms. KOLB. I don't know what the expected life is. But, again, I think that we——

Mr. WEBER. Has there been any discussion about——

Ms. KOLB. There may have been. I think what we need to focus on though, too, is there's not just one answer. There are—you know, there's solar technology, there's wind, there's biomass, there's, you know, carbon capture——

Mr. WEBER. OK.

Ms. KOLB [continuing]. And sequestration, nuclear. We need to make sure that we have—you know, we're drawing from all of these different energy sources——

Mr. WEBER. OK. Last question. I've got a minute left. Last question.

Ms. KOLB. OK.

Mr. WEBER. Given the geopolitical situation that's happening over in Russia and Ukraine and the attack that's going on and the fact that we are beholden to Russia for their oil and gas, has there been any discussion at the Department of Energy that we really ought to be thinking about this from a strategic standpoint of national security and I'll add energy security and I'll add domestic security, economic security? Because if you don't have a lot of strong fuel available, you're not going to power tanks and jet airplanes. Is there any thought that the DOE has given to the discussion of what that means to national security?

Ms. KOLB. I have not been involved in those discussions, so I don't feel——

Mr. WEBER. Yes.

Ms. KOLB [continuing]. Like I can comment on that.

Mr. WEBER. Yes, I expected so. I yield back.

STAFF. Ms. Stansbury is recognized.

Ms. STANSBURY. Thank you so much, and good morning to everyone. And thank you, Madam Chair, for convening this important hearing this morning.

As some of you know, I've actually spent my entire career working especially on water resources and climate resilience and adaptation and drought issues. I'm a bona fide water nerd to my core, and so I'm excited to be here with you all this morning.

And, you know, this hearing couldn't possibly be more timely with the release of the IPCC's adaptation report that came out last week, which not only highlighted the actions that we need to take as a world to prepare our communities for adaptation and resilience but the urgent call to action to address our carbon footprint immediately before we pass that threshold and we have such irrevocable damage and change to our planet that we can't turn back.

And similarly, a couple of weeks ago, a very important study was released that identified that currently the American Southwest is

experiencing the worst drought conditions that have occurred in over 1,200 years. And I think what these reports really reveal is that climate change is already here. Our communities are already experiencing it, and I know in my home State of New Mexico nowhere is this more clear than in our hydrologic and our water systems. And really, as I often say, water is ground zero for climate change. And so while we have to take urgent action to cut our carbon footprint, to cut emissions to prevent climate change from worsening, we have to actually engage and prepare our communities for the change that's already here.

So I've spent much of my career thinking about and working on these issues, working as a researcher. I'm an interdisciplinary science nerd working between social and natural science on water resources planning. I was a State legislator during the Obama Administration. I worked at OMB on a number of the resilience and adaptation Executive orders that some of the folks here worked on. And I also worked on the Hill before being elected to Congress on the Energy Committee working on climate adaptation and resilience. So this is really a lifelong passion.

But I think like some of the other questions that have been asked this morning and the comments that have been made is where the rubber really hits the road on climate adaptation is in our communities. It's how do we translate science data information into useful tools and resources that our communities and individual decisionmakers can actually use to make decisions that help our communities be more resilient?

And to that end in the State legislature I sponsored a *Water Data Act,* and we're planning to unveil a Federal water data act soon, which will help to create more integration and interoperability in the way that our Federal Government brings data together and helps to unlock the power of big data to help our communities.

But I want to just take a moment to say that, you know, I think that oftentimes when we talk about climate adaptation and resilience, we focus on the action and not as much on the need to integrate the science and data to make it possible to take meaningful action. And that's why think it's so important that we're having this hearing in SST (Science, Space, and Technology) this morning.

So, you know, we have to make sure that we are downscaling our climate models to actual local level models and tools that our communities can use. We have to take existing data sets that already exist, translate those into meaningful tools that our communities can actually use, and then we need to be providing resources to our communities to actually take those actions because the scale of what we're talking about, whether in New Mexico we're talking about a tribal community being able to manage their water resources, looking for the next several generations, acequias that have been managing their water resources for hundreds of years, or a farmer who's trying to decide what do I plant this season, what kind of loans do I take out, what kind of debt can I incur, will there even be water for me to plant my trees or my chilies or whatever I'm planning to plant. We need tools to be able to inform our communities so that they can make those kinds of decisions at

the granular level that really affects the kind of everyday choices that people have to make.

So to that end, Dr. Spinrad, Administrator, I'm so grateful that you're back in service. Could you talk a little bit about the need and what it would take to develop more sort of community-based tools using science and data and what that looks like and how we in Congress can help to support that enterprise?

Dr. SPINRAD. Thank you for that so much, Congresswoman. And thank you also for all of your support through the years on these issues. If I go to a product like the National Integrated Drought Information System (NIDIS)—and I know you're very familiar with NIDIS—I would argue that's an example of how we can work with stakeholders, figure out what the products and services are that we need to develop, and then iterate on that. Part of this is educating the user community. Part of it is also being able to have that user community express their requirements in ways that we can translate into science, into research and development. So we don't have a lot of time now to go into the details of it, but my basic argument would be let's take what works in NIDIS as an example, expand on that, bringing in the social sciences as you indicate, working with a broader set of users and stakeholders, and then the last element I put into this is I actually believe this is a great place for private-sector development as well because the Federal Government will never be able to provide that fine granularity of products and services that you alluded to for every user and stakeholder. But if we work closely with the private sector, we can have an effective relationship to get people what they need to make decisions.

Ms. STANSBURY. Absolutely. Thank you, Dr. Administrator. You know, I think that that kind of role for the Federal Government in convening and making its more—its own data and tools more community-based and available are really crucial in helping to stimulate that private-sector activity. And another great example—and I know I'm out of time here—is the Weather Service, right? The tools at the Weather Service and all of our science agencies bring together to make big data available to plan your day out in partnership with the private sector really are a great demonstration of how we can do this. And I think if we're going to prepare our communities for climate change, we need those kinds of partnerships across our country, across the planet, across every sector, and it's—that is what's going to be a crucial building block to helping our communities adapt to climate change.

So I really appreciate your testimony this morning. And with that, Madam Chair, I yield back. Thank you.

STAFF. Mrs. Bice is recognized.

Mrs. BICE. Thank you. As Ranking Member on the Environmental Subcommittee, I understand the importance of increasing our resiliency to extreme weather events and more frequent environmental hazards. Through this Committee we heavily emphasize the efforts to discover new technologies and prepare humans for environmental changes.

Ms. Kolb, you mentioned earlier in questioning from Mr. Lucas that, you know, you were hiring what I would consider to be a large work force that is being established through the new Office of Clean Energy Demonstrations. My concern here is that this work

force is actually taking away dollars that we could be investing in technology innovation and research to be able to really find clean energy solutions with the private sector. Can you tell me how you're sort of, you know, working through that process?

Ms. KOLB. So we are just beginning the hiring process, and, as a matter of fact, we established a portal and invited, you know, experts to apply for positions. We received 10,000 applications, and we've been systematically going through those applications because we really want to get the very best people. But we were really——

Mrs. BICE. Then why are we not partnering with other agencies? There are so many other agencies, including DOE, that have the capability to sort of take this and run with it. Why are we adding another layer with a large work force to government?

Ms. KOLB. So within DOE we have, you know, a substantial work force, and they have a lot of responsibilities. So, as I mentioned, we received $62 billion in new responsibility, and we need a good team, a good set of experts in order to make sure that this money is spent appropriately, properly, and for projects that are really going to make a difference.

Mrs. BICE. So 1/3 of the money that you've been appropriated is going just for staff, is that correct?

Ms. KOLB. I don't know how much is going to be spent on staff.

Mrs. BICE. It says $20 billion is looking to be spent to stand up the Committee. I would assume a significant portion of that would be to hire this 1,000-person work force.

Ms. KOLB. I don't know how much it costs for a 1,000-person work force, but I can't imagine that it's that much.

Mrs. BICE. OK, thank you. Administrator Spinrad, when you testified in September, you mentioned about NOAA's efforts to work closely with communities to implement preparedness plans for extreme weather events. And certainly Oklahoma knows a few things about extreme weather events. I'd like to hear more about how NOAA advertises its services. Do you think that there's public awareness for the agency and the work that you're trying to do?

Dr. SPINRAD. Thank you for that question. The short answer is some. And I actually do an informal poll as I go around the country to just test the waters and see how well-informed the public is about what we can and cannot do. Obviously, local emergency managers and a lot of county commissioners are well familiar with what we do but not enough. And so that's why programs like Sea Grant, like our regional coordinators, like our cooperative institutes all around the country through universities serve more than just the delivery function for products and services. They are also an engagement group.

And so we have actually started a program called NOAA Ambassadors to encourage our work force to, if you will, get out more and talk the talk about what we can do with school groups, with church groups, local communities, local industry, chambers of commerce. We just started that. We have a few hundred Ambassadors now. I'm optimistic that this will help get to the issue that you've identified.

Mrs. BICE. So you have these Ambassadors. Are you also utilizing State and local government entities to be able to spread the message? Because I feel like there might be some sort of disconnect

with educating the general public about the services that you're providing.

Dr. SPINRAD. Yes, I've personally taken a campaign to engage, so I've worked with the National Governors Association, National State Floodplain Managers, all of the various groups. I've worked with a number of mayors' groups as well. So I'm trying through example at my level to get our regional folks—and most of our work force is around the country; they're not in D.C.—to get them to understand that that's an important component of outreach for us. And thus far I think we've had a lot of success. The measure of success of course is how much are they reaching back to us for the products and services, and I think we're doing better on that.

Mrs. BICE. Great, thank you. I—Madam Chair, I am about out of time, and I yield back the balance.

STAFF. Mr. McNerney is recognized.

Mr. MCNERNEY. Well, I thank the Chair. I thank the witnesses. Your testimony here is very important to me and to the country, so I thank you.

Dr. Spinrad, in your testimony you discuss how NOAA's climate data, including data for solar radiation management, is instrumental in the development of a number of risk assessment and exercises, as well as climate action plans for Federal agencies. In your view, are there still major gaps or weaknesses in the data or technology used in these risk analyses?

Dr. SPINRAD. I would argue that in terms of the variety of data that we collect, greenhouse gases, temperatures, vertical profiles, humidity, I think we're doing well in terms of the variety of different observations. I could throw ocean acidification in there and sea levels and that sort of thing. The challenge for us is the quantity of the data, the resolution if you will. So if you look at something like greenhouse gas observations, we do those. We actually do it around the world. Do we have enough resolution? Are there enough measurements around the world to adequately be able to predict the variability? No. And so I would argue that we're doing pretty well on the types of measurements. We could do better on the quantity and granularity if you will of those measurements.

Mr. MCNERNEY. Are there—were there big gaps in sort of regions like the polar region that have a big impact on the weather and impact on other parts of the climate system?

Dr. SPINRAD. Yes, polar would be one. I could tell you that one of the challenges we're dealing with is enough observations in the middle of the ocean. It may sound strange, but a lot of the heat that has been generated—in fact probably 90 percent of the heat that has been added to this system is in the oceans, but we don't have observations throughout the oceans adequately enough to know exactly where it's going.

Mr. MCNERNEY. Thank you. Ms. Kolb, in your testimony you discuss the various climate hazards that put DOE facilities at risk, including the loss of electricity as a result of wildfires, which we're experiencing in the Western part of the country. What is the agency, the DOE doing to make facilities more resilient and able to function if grid connectivity is lost?

Ms. KOLB. So one of the ways that we want to make sure that we have—is have redundant power sources, so whether that's a

microreactor, a micronuclear reactor, or if it's onsite renewable energy sources such as solar or wind, that's going to be really—that's a key part of our sustainability and our adaptation and resilience strategy, making sure that we have those redundant sources.

Mr. MCNERNEY. How many—I mean, you don't have any micronuclear reactors ready to go, do you?

Ms. KOLB. Not yet, but we will. And——

Mr. MCNERNEY. OK.

Ms. KOLB. Yes, and also one of the things to keep in mind, at the Department of Energy a lot of our sites are in fairly remote areas. And one of the assets that we have, we have a lot of land. We have acres upon acres, thousands of acres of land that are vacant right now. And so one of our thoughts is that we need to put at least some of this land to better use by using it for renewable energy sources.

Mr. MCNERNEY. Thank you. As the Federal agencies create climate adaption plans to protect the infrastructure and employees and data and so on, it'll be important to create metrics to track the process. So I'd like to ask each of the panel members or anyone that really wants to step up, has your agency developed metrics to assess resilience, and how do you plan to measure your progress? Maybe Ms. Kolb would be the best to answer this one.

Ms. KOLB. Yes, I will go ahead and start. That is a challenge, and I listed in my testimony as, you know, metrics for determining, you know, our success and resilience to be a challenge for us that we are focused on because the question is how do you know when you're resilient enough? What does that look like? How do you measure that? So that is something that we're working on, and we'll be looking to our colleagues at NOAA and NASA and other places to help us with this question.

Mr. MCNERNEY. Dr. Spinrad?

Dr. SPINRAD. Yes, I echo what Ms. Kolb just said. I've got to agree that knowing where the thresholds and objectives are in resilience is important. I'd add simply from NOAA's perspective, as you saw in my testimony, I talk about lives, livelihoods, and quality of life. So there are metrics with respect to lives saved or property that did not get damaged as a result of a major storm. There are quantitative assessments we can put in there. And we are seeing progress in that regard by applying some of these measures already.

Mr. MCNERNEY. So as I run out of time, it sounds like metrics is an area where we have got some significant focus in planning for the future. Thank you, and I yield back.

STAFF. Mr. Babin is recognized.

Mr. BABIN. Thank you. I really appreciate this and appreciate the witnesses today as well.

I'm going to start out with Dr. Carney. NASA's authority to enter into new enhanced use leases, or EULs, expired at the end of last year. EULs allow NASA centers to lease underutilized property to the private sector and use those funds collected to upgrade and maintain those NASA facilities, very important.

The House passed a decade-long EUL extension in December, which I was an original cosponsor. The Senate changed that bill to only extend that authority until this month in March of '22. When

considering the Senate's amendment, the House hijacked the language, stripped the EUL extension, and turned it into a controversial voting rights bill that is now dead in the Senate.

In the meantime, California's Department of Forestry and Fire Protection (Cal Fire) sought to use the underutilized NASA Ames Research Center facility to support firefighters and their equipment. Because of the lapse in EUL authority, it appears as though NASA used a different agreement to allow Cal Fire to use those NASA facilities. The result is that NASA Ames was unable to recoup funding to upgrade and maintain their aging infrastructure to meet their growing needs. That means had we used the opportunity to pass our bipartisan bill in the first place, NASA would've had more money to be able to spend on updating infrastructure and better preparing its facilities, plain and simple, a missed opportunity. So, Dr. Carney, are there any other projects at NASA that are suffering the same fate?

Dr. CARNEY. Yes, sir. Thank you for bringing this topic up. It is, you know, one of the few levers that we do have to, you know, really focus on our underutilized facilities because we do have them. And the rate at which we can demo some of our underutilized facilities is a little bit slow in terms of our budgeting opportunities. So the enhanced use lease authority is something that really gives us an opportunity to improve those, partner with, you know, space community and/or any others that could use the facility for rocket tests or what have you.

So the one you mentioned, so Cal Fire and the Ames Research Center, that is a specific example of an EUL that's an opportunity missed. I think we may be, you know, trying other ways to try to help because we do want to help with our wildfire situation and bring to bear the—both the data and the ability that we have to inform the community about wildfires and work on that relationship.

One—another one—and so that's specific toward climate and, you know, forwarding the climate studies. Virginia Commercial Spaceflight Authority and the Goddard Space Flight, Wallops Flight Center—or Wallops Flight Facility is another example of an EUL that's in—you know, that's in consideration right now that can help us prepare and prepare for shoreline restoration issues and to protect against erosion. So the inability for us to enter in that EUL is inhibiting our ability to gain traction there is another example. Florida Power & Light with Kennedy Space Center is another example, so we're trying to use EUL proceeds to promote investments in new power and new substations.

Mr. BABIN. All right.

Dr. CARNEY. So——

Mr. BABIN. I appreciate you bringing those out because it's not just an isolated incident. This has a ripple effect all across, so thank you very much.

Now, I'd like to go to Administrator Spinrad. NOAA has extensive and advanced modeling and data that are used to support and enhance capabilities in many different ways, some of which have military capabilities. NOAA also has many international partners and collaborates on a global scale. What is NOAA doing to make sure this data has protections in place to ensure bad actors do not

have access to sensitive information? And should we be doing more?

Dr. SPINRAD. Thank you, sir. I really appreciate that. As I indicated earlier, just starting a response from a personal perspective, having spent a good portion of my career working for the Navy, I am particularly sensitive to the issues that you have identified. So we have undertaken a number of specific efforts under the direction of my Chief Information Officer. We've created a research security team specifically to look into these kinds of concerns. And the very first thing we've done is develop what we call a foreign national internal risk mitigation plan, which basically provides training and tools to ensure that we are protecting the assets and information so it doesn't go into the wrong place, let's put it that way. These have recently been stood up and already have been briefed twice on this, and I'm convinced this will be an effective tool to build the sorts of screens that your question alludes to.

Mr. BABIN. OK. I had some more to talk about, but I see that my time is up, so I will yield back my time, Madam Chair.

Chairwoman STEVENS. Great, thank you. And we're going to pass the Chairwomanship over to the great Congresswoman from North Carolina, Congresswoman Deb Ross will take over the Chairmanship. I need to head to the floor for remarks. But thank you to our witnesses again for today's really important hearing. It was a delight and honor to be with all of you.

Ms. ROSS [presiding]. Great. OK. Is Congressman Casten next?

Mr. CASTEN. Happy to be if you'll allow me to be.

STAFF. Yes, Mr. Casten is recognized.

Mr. CASTEN. Thank you, Madam Chair. I've got to admit I am—you know, the longer I am in this line of work, the more speechless I am at how many of my colleagues think that we can debate the law of physics and put people's lives at risk. The IPCC report just came out and said that climate change is outpacing our ability to adapt. We had $160 billion in insured losses last year. Forty percent of Americans faced extreme weather events, and my colleagues think we should stop investing in wind because Texas failed to winterize them. My God, what is our job here? To embarrass our grandchildren? These are serious issues. This is massive.

So, Dr. Spinrad, I want to thank you for the NOAA report you just issued on sea-level rise. It scared the bejesus out of me. That report, if I'm following it right, you know, included, among other things, predicting 14 to 18 inches of sea-level rise on the Gulf Coast by 2050, 12 inches in Sarasota County and Manatee County in Florida by 2050. Do I have those numbers about right? Am I—I don't want to misrepresent it. But——

Dr. SPINRAD. They're very close. And the important point if I can is that the accuracy of those numbers, the ranges are very small. That's really the important point. There is no longer any equivocation about this happening.

Mr. CASTEN. Well, thank you for scaring me more. Do you have a sense of how many homes are at risk of loss at that level of sea-level rise?

Dr. SPINRAD. Not that number specifically, but I do know that the number we use often is that 40 percent of the U.S. population

resides in coastal counties, so one can get some indicator from that number.

Mr. CASTEN. OK. Well, your—I don't know the number either, but your report drove me to spend a lot of time looking at topographical maps of the United States. And, you know, if I'm just eyeballing it, it looks like most of Louisiana south of I–10 is at risk of loss. It looks like, you know, significant portions, you know, certainly—maybe not 10 percent but getting close to 10 percent of Manatee County looks like it's within that sea-level bend. This is by 2050.

Now, I really appreciate your report. I really appreciate your effort to sort of localize this within communities. I am troubled by the interagency communication. I served on the Financial Services Committee. We had Chairman Powell before us—Chair Pro Tem Powell I should say—last week, and when I read those numbers to him, I asked him whether Fannie and Freddie are making any effort to modify their lending agreements because an 18-inch sea-level rise on the Gulf Coast by 2050 means there are homes that will mortgage today that will be lost before that mortgage is repaid. He had a very short answer to me. No. I then asked him whether there was any reason to believe that the commercial bank sector is not going to look at the Federal Government and say these suckers will take our risk, I'm going to start offloading all my long-term mortgages onto Fannie and Freddie. He said that seemed reasonable.

I don't want to reiterate all that, but we are looking at massive loss of wealth on the coasts. We have a massive political problem as long as my colleagues keep thinking this is a good problem to politicize rather than to face up to. And I'd like to understand to what degree are you—what is the interagency communication on this look like with the Fed, with Treasury, with the folks who have a very narrow amount of time but potentially an amount of time to if we can't physically protect ourselves, can we at least financially protect ourselves from some of these risks? And when the Fed isn't even thinking about it yet, I'm nervous about the clock. So can you help me out with what you've been doing on that?

Dr. SPINRAD. Yes, I think I can a bit with some information as recent as last Friday. So when I came onboard as NOAA Administrator, we established NOAA climate councils, basically my most senior career and political folks that are working all of the climate issues. And I said one of the things we're going to do is work in a sort of bilateral fashion with our agency partners. On Friday we had an hour discussion with leadership from the Department of Treasury talking about physical risk, financial risk, transition risk, and they are sharing with us their needs for products and services. We're doing the same thing with our other agency partners as well.

I should point out the sea-level rise product you talked about was done collaboratively with our partners at NASA and many other Federal agencies, so there's both the formal interagency engagement and then what we are initiating in our respective agencies. And I am encouraged that we're having a meaningful dialog. I can tell you in my 35 years in Federal Government I could count on one hand the number of meetings I've had with Treasury. This was

the most significant, and I'm encouraged there's a good way forward for co-development products.

Mr. CASTEN. OK. Well, I'm about out of time. I'm glad to hear you're doing that. I would just—hopefully, you won't disagree with me that what we are all doing—or trying to do this not yet enough because as long as the Chairman's answer to that question is no, we've got a real problem.

And I'll end with the way I started. We are sitting here right now with our colleagues in the Senate refusing to even confirm people to the Federal Reserve because they have the temerity to suggest that we should actually understand this math when regulating our financial system. And, as my colleagues have heard me say many times, I'm a firm believer that the only thing that matters in this life is whether your grandchildren can say they're proud of you. And some of my colleagues are failing that test right now. Thank you. I yield back.

STAFF. Ms. Kim is recognized.

Ms. KIM. Thank you. I'd like to thank all of our witnesses for appearing before our Committee today. And I also want to congratulate NASA and NOAA on its successful GOES-T (Geostationary Operational Environmental Satellite—T) launch, and I'm very much looking forward to its contributions to meteorology, including improved monitoring of wildfires on the West Coast.

As you know, California, the State that I represent, is currently facing a record-breaking drought and continues to grapple with fire seasons that look more like fire years. And according to 2021 Cal Fire numbers, over 8,800 wildfires destroyed 3,629 structures and they took three lives and burned 2 1/2 million acres.

I know before me Representative McNerney directed this question to DOE, but I would like to direct the same questions to all of our witnesses today. So, Dr. Spinrad, Ms. Kolb, and Dr. Carney, what actions are your agencies taking to mitigate the risk of losing structures in California and in other Western States to wildfires? And, Dr. Gomez, what are your recommendations for NASA, NOAA, and DOE to mitigate the risk of wildfires damaging infrastructure?

Dr. SPINRAD. I would be glad to go ahead and start the answer. As you know, NOAA has a number of equities that we bring to the table with respect to addressing wildfires. The first, of course, is our ability to detect them, using the sensors on platforms like the satellite we just launched which has a lighting mapper on it so we can start to help mobilize responders to where we think the fires are going to break out. We also have incident meteorologists that are on scene to provide the up-to-the-minute forecast information that the firefighters and responders need. And then of course we provide predictions both of the larger weather picture and the micro-weather that's happening within the fire.

All of those efforts are standard operating procedure for us, but it's not good enough. So in our '22 President's budget we actually included some increases for more incident meteorologists also to build a fire weather testbed to improve our products and services. So we are continuing to grow that effort. We're continuing to work closely with our colleagues in FEMA (Federal Emergency Management Agency) and in the State forestry offices and Cal Fire, for ex-

ample. And so basically it's an enhancement of the products and equities that we have built over the years to provide a broader set of applications.

Ms. KIM. Thank you. Ms. Kolb?

Ms. KOLB. OK. Well, thank you very much for that question. As you know, we have four laboratories in the State of California, and they are laboratories that are very important to us. And fortunately, none of them have been directly threatened by wildfires except what has happened, for example, at Lawrence Berkeley National Laboratory. They had to shut down operations because PG&E (Pacific Gas and Electric Company) had to, you know, cut the flow of electricity to deal with wildfires. And so that meant our operations went down. And given the important missions that the Department is responsible for, you know, that's just not acceptable to us. So what we are doing at that laboratory, as well as our other laboratories, is making sure that we have redundant power sources onsite so that we have that backup generation if the flow of electricity to our site is cutoff.

Ms. KIM. Thank you.

Ms. KOLB. So that is the main thing that we are doing.

Ms. KIM. Dr. Carney?

Dr. CARNEY. Yes, thank you. So we have the variability also with three field centers in California, and we have the, you know, flooding concerns and Ames up in San Francisco. We have Jet Propulsion Lab in southern California, and then we have the more arid Armstrong. And so we have quite a variety of climates to deal with in those three centers and are interested in helping move that forward.

But, you know, specific to the wildfires, both our Science Mission Directorate and our Aeronautics Research Mission Directorate are intimately involved in trying to help with the wildfire analysis, the data collection, and then the decisionmaking on—you know, based on that data and working with the local communities to respond and mitigate those wildfires. And so, you know, some of the examples are a program called STEReO, which is Scalable Traffic Management for Emergency Response Operations. We also have Global Fire Emissions Data base that is something we can access. And, again, we collaborate with many of the panel members here, as well as others in the community. So we have—this is one of the good examples, I think, where we are actually integrating with the local community and really informing them and trying to help them make decisions at the local area to try to save lives and save infrastructure.

Ms. KIM. Thank you. And I will get—time is running out, but I want to ask a quick question to Ms. Kolb. The Department of Defense has stated their goal is to use technological developments like quantum computing, 5G, artificial intelligence, and data analytics to increase their capacity to forecast, predict, and plan for climate and national security risk. And that also extends to extreme weather events, food scarcity, water shortages, and beyond. So can you talk about DOE's work in these advanced technology fields and how the Department is applying those to assist in Federal climate adaptation efforts?

Ms. KOLB. So absolutely. First of all, at a couple of our laboratories, Argonne National Laboratory in particular as well as our Pacific Northwest National Laboratory, we have some of the world's best climate scientists that are working on all the issues that we were talking about. Also at these laboratories and our others as well we have, you know, tremendous supercomputer capabilities, you know, the quantum computing that you were mentioning, work in artificial intelligence. I mean we just—our national laboratories are a tremendous resource.

And they are working collaboratively to develop technologies, clean-energy technologies that are going to help build greater resilience not only at our laboratories but for the Nation as a whole. So they are very actively working on that. Some specific areas that they're really focused on are——

Ms. ROSS. Ms. Kolb——

Ms. KOLB [continuing]. Nuclear energy——

Ms. ROSS [continuing]. Your time has gone well past expired, so if you could wrap up quickly, that would be great. Ms. Kolb.

Ms. KOLB. Nuclear energy, carbon capture and sequestration are just a couple of examples.

Ms. KIM. Thank you. Thank you, Ms. Ross, for allowing me to go over time with our witness. Thank you.

STAFF. Ms. Moore is recognized.

Ms. MOORE. Thank you so very, very much. This is a very important hearing. And I want to thank all the witnesses for their expert testimony.

And I'm really so glad that just after one week of being President of the United States, Joe Biden signed this Executive order to put together a program to tackle climate change and to focus on collaboration, assess our vulnerabilities, adaptation, and resilience. Part of that Executive order was to have 23 agencies come together to collaborate.

And I guess one of the things that I have not noticed at least in this hearing if there's been any discussion of a medical infrastructure. I had my very first asthma attack as a child shoveling coal into a furnace. And of course we do know the health impacts of climate change, you know, whether it's wildfires, you know, coal or whatever the cause, asthma, greenhouse gases, heart disease, heat strokes, hypothermia. So what can you all tell me about the collaboration you're doing with HHS (Department of Health and Human Services) to—in anticipation of this? What will you do with very, very sick people who suffer from climate acts? Just that—since HHS is not here, just shoot it to the panel to—whoever to answer that that may feel most qualified to do it.

Dr. SPINRAD. Congresswoman Moore, thank you for that. I'm not sure I'm the most qualified, but there is a very specific part of the answer that I wanted to share with you. And when the White House stood up the National Climate Task Force under the leadership of Gina McCarthy, we established five working groups, one of which is an interagency working group on heat health with a specific focus on extreme heat. But we're not limiting it necessarily to just heat health. I co-chair that with HHS Secretary Becerra and with EPA Administrator Regan. We have used this body to aggressively go after developing a national integrated heat health infor-

mation system modeled after the NIDIS, the Integrated Drought Information System, to do exactly what you're talking about for the issues of heat health. That is one piece.

The other that I can share from a NOAA perspective is we have begun a very active dialog with the American Medical Association, a group we had never talked with before. When I called them, their first reaction was why are you calling us? By the time we were done, we had agreed to have joint committees to work on a variety of things from dermatology to public health to climate impacts and environmental impacts on a broad array of medical issues. So there's two examples of where I'd say the Federal agencies are working aggressively to address a spectrum of heat—or health issues.

Ms. MOORE. Another question, I know that NOAA is really doing the technical support around map—the mapping program. And when we think about people who live on the water, we think about people who live in the mansions on the Great Lakes or something, but there are plenty of poor people—I mean, think Katrina, who live near water. And I'm wondering if your mapping specifically sort of disaggregates people who live—you know, the rich people by the waterfront and poorer communities so that a response can go to the most needy in terms of building up that infrastructure? I mean, you know, poor people can't just jump in their big SUV (sport utility vehicle) and escape a climate activity, so I'm wondering if there's a disaggregation of those data?

Dr. SPINRAD. Very briefly, one of the advantages of NOAA's being in the Department of Commerce is one of our sister bureaus is of course the Census Bureau, so we have worked with the Census Bureau effectively to develop a map of climate vulnerability by socioeconomic indicators so that you can do exactly what you're talking about. You can look at a coastal area and say where are those lower, more impoverished areas where the ones where, for example, English may not be the predominant language so that we know how to get information out attuned to the needs of those communities.

Ms. MOORE. Thank you so much. And so the Great Lakes—I got 14 seconds. You guys—I mean, 50 percent of our trade is between the United States and Canada, goes through the Great Lakes. Is this a focus of your work? Dr. Spinrad?

Dr. SPINRAD. Yes, absolutely. We could go into a great bit of detail, but working with the Great Lakes Environmental Research Lab, with our Sea Grant programs, with the joint Canadian Government bilateral agreements we've got in treaties, absolutely, yes.

Ms. MOORE. I thought for sure the Chairwoman would indulge me to talk about the Great Lakes, so I squeezed it in. Thank you, and I yield back.

STAFF. Mr. Feenstra is recognized.

Mr. FEENSTRA. Thank you. Thank you, Chairwoman Ross and Ranking Number Lucas, and thank you to all our witnesses for their testimony and sharing your extensive experience and knowledge on this subject.

Before I begin, my family and I are praying for those that were impacted by Saturday night's devastating tornadoes in Iowa and the families that were tragically lost, lost loved ones in this tor-

nado. We all know these storms all too well in Iowa and the toll they take on our farmers and our families and our businesses. But in Iowa we're always resilient.

Administrator Spinrad, it's no secret that NOAA has had its fair share of dissemination issues, including during the Iowa tornadoes this past weekend. We can collect all the data in the world, we can run the best models and know exactly what is going to happen, but if we can't get the warnings and alerts out to the public in a timely manner, the effort is wasted.

Related to this tragedy, on Saturday there was a lot of technical issues with the National Weather Service that delayed wireless emergency alerts up to 7 minutes. As you know, we've discussed in earlier hearings quick and timely weather detection and alerts are absolutely crucial for those in my State, especially when we have deadly severe weather events like the tornado of this past weekend. Can you elaborate on what caused—what causes these delays during events like we had over the weekend, and what steps we can do to prevent some of these dissemination delays so they don't continue to occur?

Dr. SPINRAD. Thank you, Congressman. Let me start also by expressing my condolences and my sincere sympathies to the families of the seven individuals who passed away. That's unacceptable. We can't have deaths.

I will share with you that for the reasons that you indicated we have built a lot of redundancy in the communications mechanisms that we've got, so it can be NOAA weather radio, it can be through chat, it can be through a variety of social media. All the—in this particular case we had advisories going out 5 days beforehand, and the lead-time for the warnings in all cases was 20 minutes, which is well beyond what the average is.

Dr. Marshall Shepherd had a good piece in today's *Forbes,* which I would recommend to your staff to take a look at. The issue of addressing the individual delays in one of the redundant systems is something we're looking into. We will get back to you once we've done the full after-action analysis of what the root cause is. But fortunately, none of the—everyone who was in the path was—they had a warning available to them in the 20-minute lead-time. The full redundancy was not there because of the gaps you alluded to, and we are looking into what the cause of that was.

Mr. FEENSTRA. Well, I appreciate that, Administrator Spinrad. And, as you said, you know, just one loss of life is too much. And anything that we can do collaboratively from Congress and working with yourselves, I'm all in because whether it be Iowa, Oklahoma, or whatever, you know, it continues to occur.

I have one other question for you, Administrator. You mentioned NOAA's joint work with the National Institute of Standards and Technology, NIST, to identify and utilize appropriate climate data for application and building standards. As the new Ranking Member on the Research and Technology Subcommittee, I'm interested in supporting more cross-agency collaborations like this. Can you give us an overview on how NOAA identifies and then executes research with other science agencies like NSF (National Science Foundation) and NIST? Something like NSF's Wall of Wind comes to mind and its usefulness to hurricane forecasts and modeling at

NOAA. How can we increase and then sustain mutually beneficial research?

Dr. SPINRAD. Yes, thank you for that question. There is a lot of detail I could get into. I would love to come and brief you and your staff on the more detailed answer to it. But in short, we have a number of mechanisms in place. So what you alluded to is actually part of the Department of Commerce Climate Adaptation Plan that we're working on collectively with NIST. We have the benefit through the Office of Science and Technology Policy in having a robust interagency tool. We—ICAMS, the Interagency Committee on Advancing Meteorological Services, that's where all of our agencies sitting here on the panel actually get to discuss plans and programs for coordination of efforts associated with everything from weather forecasting to resilience.

We also have a number of bilateral agreements. I call out our agreement with NASA, for example, on how to take the data that NASA collects and the data that NOAA collects and feed them into the models more effectively, so any number of mechanisms. I welcome the opportunity to give you a more detailed explanation.

Mr. FEENSTRA. Well, thanks. I'm excited to hear that, wonderful. And with that, I yield back.

STAFF. Ms. Ross is recognized.

Ms. ROSS. Excuse me, could you repeat that?

STAFF. Sorry, Ms. Ross, you're recognized.

Ms. ROSS. Oh, thank you very much. I thought it was going to be Mr. Foster, but I appreciate his patience.

So thank you so much to our Chairwoman Johnson, who could not be here, Ranking Member Lucas for holding the hearing, and to all of our witnesses for being with us.

As we know, the Federal Government is not immune to the effects of climate change. And in conjunction with our larger climate change objectives, we must ensure that Federal facilities, programs, and investments are equipped to be climate change-ready, resilient, and adaptive.

As of 2020, my State of North Carolina was second only to Texas for the number of weather and climate-related disasters that cost $1 billion or more. Aside from the harmful effects this has had on our economy and environment, these kinds of consequences stretched Federal resources, facilities, and programs thin. I'm interested to hear today about how all of your agencies are working across the government to mitigate the harms of climate change, which we know are only expected to worsen.

My first question is related to some work that's been done at North Carolina State University, which received a $5 million grant from NOAA to lead a multi-institutional effort to develop climate resilience solutions in frontline communities in North and South Carolina. And this will dovetail a little bit with what Representative Moore asked about.

Dr. Spinrad, how would local projects like these help NOAA achieve its larger climate resilience and mitigation goals? And how do we ensure that the research conducted through these grants aligns with NOAA's climate mitigation goals?

Dr. SPINRAD. Thank you for that question. And I'll start by thanking Congress for the infrastructure resources that have been

provided. You have our spend plans for review right now. And for NOAA, something close to $1.5 billion of those additional resources are going to go toward coastal resilience, also marine pollution. But this will leverage our investments and will be largely supported through grants and awards not unlike the one that you alluded to to NC State to individualize if you will what the solutions are. Are there nature-based solutions? Can we build out marshlands? Can we strengthen or nourish beaches, for example, to mitigate against sea-level rise? So you will see a major investment.

I will add that all of the spend plans associated with resilience are being—and specifically infrastructure are being coordinated. The White House is starting up a climate start—Climate Smart Infrastructure Task Force to look at how we are coordinating across all the two dozen roughly agencies that are addressing specifically elements of coastal resiliency.

Ms. ROSS. Thank you very much. Also, North Carolina's 2020 Climate Science Report drew conclusions generally consistent with other dire climate change warnings, including the threat of surge flooding as a result of rising sea level. Dr. Carney, what kinds of immediate steps can be taken to protect NASA's infrastructure along the coast from rising tides, and what impact will inaction have?

Dr. CARNEY. Right, well, thank you for that question, and a very timely one also. And so just I would like to say that, you know, our Science Mission Directorate is really leaning forward here, and I would have to call out the Disasters program area of NASA's Earth Science Applied Sciences Program as evidence of one area that we're leaning forward to try to provide that exact data that you're talking about in terms of not only seeing the flood—flooding data as it's happening real time but also be able to project what regions would be inundated, you know, soon after, and so help to plan with the local communities and move that forward.

As I've said in this testimony, a lot of our launch infrastructure of course is susceptible to flooding. It's at least in the range. We are bolstering up those areas to protect from the flooding impact so that we can maintain our access to space throughout and even with the high-end flooding predictions that ourselves and NOAA have gone together to measure. So we feel like we're ready to sustain and maintain given our shoreline impacts and the efforts we've done to become more resilient on those shorelines.

Ms. ROSS. Thank you, and I yield back.

STAFF. Mr. Obernolte is recognized.

Mr. OBERNOLTE. Thank you very much, Mr. Chairman. My question is for Ms. Kolb. I really enjoyed your testimony. Can you talk a little bit more about the tools that the Department of Energy is using with respect to emerging technologies like quantum computing, artificial intelligence, advanced data analytics? Those, as we're all aware, have an incredible potential for allowing a more detailed and accurate prediction of the effects of climate change on our infrastructure and of our efforts to implement climate resiliency. Can you talk about how the DOE is catalyzing the use of those tools for those purposes?

Ms. KOLB. Yes, absolutely. So, first of all, the Department of Energy has, you know, the fastest computers in the world. Our super-

computing capability is, you know, just the best in the world, as I said. And we are using that supercomputing capability to address issues with regard to climate change. And that is something we're very focused on, especially at our Argonne National Laboratory. They are using their supercomputers and, you know, the information that they're getting through their climate science work to produce models, and they work very closely with NOAA on this as well. And right now, you know, they have models. They have been refining their models. And very soon in the next few months they are going to be posting a lot of this information online so that communities can use this very detailed information so that they can begin to prepare for climate change in a more active way. So that is something that we are definitely doing at Argonne National Laboratory, as well as other laboratories like our Pacific Northwest National Laboratory, so a very key component to our efforts.

But something else that I want to mention, too, there's been a lot of discussion about how can agencies work together. And one of the tools that the Department of Energy has is we have an organization called the Federal Energy Management Program. And the purpose of this program is to work with agencies on adaptation, resilience, sustainability efforts. So, for example, they developed a tool called the Technical Resilience Navigator, and that tool has been distributed to all agencies to help them with their vulnerability studies, to help them determine what actions are needed in order to address climate change. And they also provide technical assistance to help with that effort. In addition, they provide funding for Federal projects, so that is something that, you know, we're very proud of, and it's a way that we lift up the entire Federal community.

Mr. OBERNOLTE. Great. Well, I'm certainly not surprised to hear that the DOE is taking a leadership role in that effort. But I'm very happy to hear you talk about how collaborative these efforts are because obviously we can be the point of the spear in conducting research and coming up with answers here, but it's meaningless if we don't take a collaborative approach and disseminate that information and the tools that we use to collect it to the agencies that are going to be affected most by those resiliency efforts. So I'm very happy to see you taking a leadership role there and hope you continue.

Mr. Chair, I yield back.

STAFF. Mr. Foster is recognized.

Mr. FOSTER. Yes, thank you. Am I audible and visible here?

STAFF. You are, sir.

Mr. FOSTER. Well, first, I want to express my disappointment that the question that Representative Obernolte asked was exactly the one that I intended to ask. And I want to say—so I guess great minds think alike here. But I was very encouraged, well, first off, at the centrality of Argonne's role in this and also the importance of collaboration. As a Member who represents Argonne, it always makes me smile when I don't have to be the one that brings up their importance.

But I was very struck by Dr. Carney's observation about that 2/3 of the economic value of their assets are less than 16 feet above sea level. And so that's an interesting point on what I imagine is

a curve that I imagine you prepared. You know, what is the total amount of economic value at risk as a function of the sea-level rise? And is that something that you've mapped out for the entire range of sea-level rise estimates?

Dr. CARNEY. Good question, thanks. So, yes, very—we have been thinking about that, and we have done extensive sort of studies to look at what are the potential impacts. Of course, as the reports have come out, you get a little bit more clarity to what some of those expectations could be. We've heard the numbers of 12- to 18-inch sea-level rise by 2050 as—you know, as an approximate value for those to expect. So we've done our own internal studies, for example, at Kennedy Space Center to try to understand what that means. And, as we all know, that's a low-level coastal area, and it's an area that we would anticipate almost 25 percent of that land being enveloped by water.

We do believe that our critical infrastructure would be safe in these cases, but again, it's a growing concern and something that we're trying to address with a lot of our shoreline protection efforts. And, you know, so similarly, the Wallops Flight Facility has a, you know, a similar topography, right, around the coastline, so we're working toward that.

Mr. FOSTER. Well, no, it's good that you're thinking about the whole range because, you know, even if we decarbonize our economy, there's no guarantee that other countries will. And so we really at least have to have a plan to protect ourselves against potentially much higher levels of rise of sea level.

Ms. Kolb, does the DOE have a comparable estimate? Are there particular facilities, you know, JLab (Jefferson Lab) or Brookhaven that might be at risk from significant sea-level rise?

Ms. KOLB. The facility that we're most concerned about when it comes to sea-level rise is the Strategic Petroleum Reserve, which is on the coast in Louisiana and in Texas. So they have already, you know, been subject to hurricanes and flooding, and they have been very proactive in, you know, making sure that they're protected for future events. So they have fortified a number of their facilities, and they have also, you know, elevated their equipment so it doesn't—you know, it's not subject to flooding. But that is the facility I would say that we're most concerned about with regard to sea-level rise.

Mr. FOSTER. OK. The national labs, though, are high enough that they're not a cause for immediate concern?

Ms. KOLB. We believe they are at this time, but all of our laboratories' sites are all doing vulnerability assessments. Those assessments will be completed by this September, and so they will, you know, determine whether or not they feel that they're vulnerable. And also they will be developing action plans that—you know, where they're prioritizing their actions. So we will see the results of that.

And I just want to add because I haven't had a chance to add this yet, the folks at NOAA do a fantastic job. We had them come in and do some workshops for our teams that are developing these vulnerability assessments, and they provided us with the tools and instruction on how to use the tools so that we can really zero in

to specific parts of the country and determine the vulnerability of our sites. So thank you to NOAA for that.

Mr. FOSTER. Now, last year, I introduced the *Restore and Modernize Our National Labs Act,* which has a companion piece led by Senator Luján. And it was recently included as an amendment in the *COMPETES Act* that provides significantly more funding for national labs to pursue deferred maintenance generally. And so are you in a position now of—if this money actually gets delivered by Congress to do that deferred maintenance and other critical infrastructure in a way that's consistent with this plan? Or will you need more time to think through the climate resilience aspects of the money that we're hopefully about to deliver to you?

Ms. KOLB. We will want to make sure that, you know, we give a lot of thought to spending the money. We want to make sure that, you know, we're spending it on the right things. So we would take a look at, you know, the plans that are submitted, the prioritized actions, and would use the funding to address the top priorities. So—but we would take care of it. We definitely would.

Mr. FOSTER. Thank you. My time is up, and I yield back.

STAFF. Mr. Beyer is recognized.

Mr. BEYER. Thank you very much, whosever chairing this meeting right now. I really appreciate being a part of this.

You know, I am glad we're having this conversation about climate resilience. I live right across the river in Alexandria, and it seems to be a hotspot for flooding. And it's not just the river which continues to rise but the fact that it—these 100-year rainstorms that are now happening every summer overwhelm the streams, they overwhelm the stormwater systems. You have houses that are 4 miles from the river that—whose basements are flooding as they come back up through the drain systems. And I don't even live in Norfolk or Virginia Beach where you have to check the radio or the TV every morning to figure out how you're going to get to work based on the flooding.

With Congressman Brian Mast, a Republican, we have the *National Ocean and Coastal Security Improvements Act* to address exactly this. It's dedicated funding for coastal resilience. You know, I'm afraid, though, it's not nearly the scale that's needed, but it's a start.

Dr. Spinrad, from your NOAA perspective, can you speak to the National Coastal Resilience Fund and how much more demand there is and what the funding can support?

Dr. SPINRAD. Yes, thank you, Congressman Beyer. The issues you've raised are ones that are central to our investment in coastal resilience, and so obviously the additional resources being provided in the *Infrastructure Act* that will go to this are going to be critical.

Our challenge is going to be basically to improve predictive capability and downscale it if you will. So it's one thing to say that in the East Coast of the United States we're going to see rainfall of a certain amount and therefore we can expect a probability of flooding of X percent. It's another thing to be able to get it down to the street level, to the block level and say this part of Alexandria will flood, this one will not, working closely with a number of other agencies, especially in Interior. We're trying to develop improved flood forecasts through improved investments in hydrology overall.

So the national—the Coastal Resilience Fund that you alluded to will include solicitations specifically for improving the accuracy and the resolution of those forecast products.

I've got to say you brought out a key point, and that is that we tend to think of the flooding issues in terms of these traumatic major tropical cyclones, but what some people call the nuisance flooding or sunny-day flooding or king tide flooding is probably an even more pernicious problem in terms of the increased frequency, so we're going to be putting a lot of effort into that aspect of the coastal flooding issue.

Mr. BEYER. And, Dr. Spinrad, I can tell you it's often the No. 1 local issue for those folks who are—have the disadvantage of having to serve their local constituents.

Ms. Kolb, I just want to thank you for your leadership at the Department of Energy, and I'm just so thrilled that the White House is having its first-ever summit on fusion power coming up on March 17th. As we think about the alternatives, if we can advance fusion power by 30 years, the difference it will make in terms of carbon is just enormous.

And, Dr. Carney, you're still with us. The—you know, we've heard from Senator Administrator Nelson that his No. 1 infrastructure goal is the bridge to Wallops Island. And as Virginians, we love that bridge or love the new bridge. But I'm worried that virtually all of our launch facilities border water, for good reasons, so we're worried about beach erosion and the ability to maintain launch capabilities at Wallops and Canaveral and other places. Can you talk about that a little bit?

Dr. CARNEY. Yes, sir. It's—it is a concern. It's one of our top concerns. And obviously, access to the Wallops Flight Facility on the bridge is a big piece of our infrastructure, and we plan on getting that done. So, yes, I mean, again, that access to space is one of our critical pieces. It's our No. 1 piece of our climate action plan is to maintain access to space. And obviously Kennedy Space Center and Wallops Flight Facility are two of our primary access points. And so we will do everything we can in our, you know, capability to protect those zones. We've done a shoreline restoration program down at Kennedy Space Center to actually—to build the shoreline up to protect those launch facilities, as well as grow grass there and things like that that we hope will protect erosion in the future as it comes in because we do expect to have more coastal storms and more impact. So we—it is No. 1 on our list in terms of, you know, making sure that launch availability is there.

Mr. BEYER. Great. Thank you very much. I really appreciate it, and I yield back.

Ms. ROSS. Are there any other Members seeking to ask questions?

OK. Before we bring the hearing to a close, I want to thank our witnesses for testifying before the Committee today. The record will remain open for two weeks for additional statements from Members and for any other questions the Committee may ask of the witnesses.

The witnesses are excused, and the hearing is now adjourned.

[Whereupon, at 12:13 p.m., the Committee was adjourned.]

Appendix I

Answers to Post-Hearing Questions

ANSWERS TO POST-HEARING QUESTIONS

Responses by Dr. Richard Spinrad

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

Questions for the Record to:
Dr. Richard Spinrad
Administrator National Oceanic and Atmospheric Administration

Submitted by Representative Bill Foster

1. **Supercomputing capacity is critical for NOAA to be able to promote climate adaptation and resilience. NOAA requires supercomputing for both its research and its operations. However, limited supercomputing capacity constrains the agency. The Department of Energy has been raised by some as a potential resource for additional supercomputing capacity.**
    a. **How might it be helpful for NOAA to be able take advantage of the supercomputing resources at DOE if it were made available?**

The Department of Energy's (DOE's) high-performance computing (HPC) assets support researchers across the nation in providing state-of-the-art networking and software tools to maximize scientific impact; however, DOE's HPC mainly supports R&D, and in general does not support NOAA's operational mission. NOAA could leverage the DOE's open science computing platforms to explore and develop new HPC infrastructure for NOAA. Running NOAA models on DOE's different computing platforms and technologies could allow for innovation and advancement of not only new HPC technologies but also new and cutting-edge NOAA models. In addition, utilizing DOE's computing infrastructure could lead to improvements in data assimilation by using NOAA's growing collection of high-quality environmental data while also improving model performance (i.e., speed and accuracy), harnessing complex interactions within the models that are often computationally expensive, and leveraging machine learning concepts that could reduce the cost to run high-resolution global models for both research and operations.

NOAA already benefits from DOE's supercomputing resources by leveraging the Oak Ridge National Laboratory's (ORNL) expertise. NOAA partners with DOE to host and support NOAA's Geophysical Fluid Dynamics Laboratory's (GFDL) main supercomputing asset, *Gaea.* However, there are trade-offs with outsourcing the lease of our HPC compared to NOAA leasing directly. The increasing disconnect between users and HPC vendors has led to inefficiencies in design, support, and throughput. Additional investment focused on climate applications should be made to ensure preparedness for exascale architectures and beyond, and having this investment dedicated to NOAA models and scientists would ensure progress in developing next-generation models.

b. **Given NOAA's life-saving mission and operational time-sensitivity, is it appropriate for operational supercomputing to be outsourced, or is it more appropriate to only consider outsourcing to DOE supercomputers for research purposes?**

NOAA is mandated to provide weather, water, and climate data, forecasts, warnings, and impact-based decision support services for the protection of life and property and enhancement of the national economy. NOAA requires consistency across our supercomputing infrastructure that efficiently carries out our mission in a reliable manner. DOE's approach to high-performance computing (HPC) pushes the edge of technology and is meant to support scientific research and innovation over longer time horizons. NOAA's approach diverges from DOE's, with the mission-critical product generation and scientific development that NOAA relies on to protect life and property in an operational capacity. NOAA requires commercially available, reliable state-of-the-art architectures that are consistent between NOAA model development and operations. Therefore, it is not appropriate for operational supercomputing to be outsourced at this time.

To fulfill these requirements, NOAA has competitively awarded commercial HPC contracts for both operational and research mission areas which cost-effectively provide the high availability capacity required by NOAA's life-saving mission. This includes providing NOAA the ability to shift its processing within minutes between two geographically disparate HPC sites while also providing efficiencies to quickly transition NOAA research to operations. This capacity enables NOAA to provide nimble, immediate, impact-based decision support that saves lives and protects property during inclement and extreme weather events.

NOAA's HPC strategy embraces the need to adopt the latest HPC technologies and plan for emerging uses of HPC. NOAA maintains strong relationships with interagency partners, including DOE, and participates in coordination activities with the National Science and Technology Council. Coordination occurs across initiatives, from the Future Advanced Computing Ecosystem, National Information Technology Research and Development, U.S. Global Change Research Program, and Interagency Council for Advancing Meteorological Services, which are essential to advancing earth systems modeling as a whole by ensuring that NOAA's requirements are represented within national computing strategies.

NOAA's HPC approach provides opportunities for innovation using cutting-edge technology that leverages other computing resources such as DOE's Innovative and Novel Computational Impact on Theory and Experiment (INCITE) program and the National Science Foundation (NSF) Advanced Cyberinfrastructure Coordination Ecosystem: Services & Support (ACCESS) program and its

precursor, the Extreme Science and Engineering Discovery Environment (XSEDE) Program. NOAA's HPC environment enables NOAA scientists to apply for and obtain grant hours on DOE and NSF systems by providing appropriate connectivity and support for use of these systems. These opportunities enable NOAA to gain competence and experience in the novel architectures provided by DOE and foster interagency collaboration while allowing NOAA's traditional computing assets to carry out NOAA's research and operational mission. These programs provide an important resource to investigate advances in research at scale; however, more focused resources are needed to provide stable and dedicated resources for developing and transitioning models from research to operations.

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

Questions for the Record to:
Dr. Richard Spinrad
Administrator National Oceanic and Atmospheric Administration

Submitted by Representative Mikie Sherrill

2. **NOAA and agencies like the EPA, FEMA, Army Corps, have important information about environmental and weather hazards, local hydrology, floodplains, mitigation opportunities, all sorts of data that help local communities make climate-smart decisions. I was encouraged to hear that NOAA is making an effort to help vulnerable communities use those resources to make decisions.**
    a. **But with so many different sources of data available to the public, how can local planners, especially in small towns with few resources like those in my district make sense of all the different agencies' websites, platforms and data sources?**

    NOAA is an authoritative federal provider of climate information, data, and services and works to provide this information to our federal, state, tribal, and local government partners. NOAA provides the US Climate Resilience Toolkit, which offers information from across the federal government. Additionally, in response to Executive Order 14008, Tackling the Climate Crisis At Home and Abroad, Section 211(d), NOAA co-led a report with the White House Office of Science & Technology Policy (OSTP) and Federal Emergency Management Agency (FEMA) titled, "Climate Information and Services for the Public," on ways to expand and improve climate forecast capabilities and information products for the public. The report addresses the key needs for a seamless spectrum of forecasts, information, and services to enhance preparedness for the next disaster and for long-term climate-related impacts; and a need to improve the accessibility and utility of U.S. Government climate information, which can be difficult to navigate and is often not at the scale or in the format needed to support decisions.

    NOAA recognizes that local planners need access to locally relevant and timely data and the capacity to understand and use data varies across communities. For that reason, NOAA has numerous networks at the regional and local level that help users navigate the many different sources of data and assist local communities in making informed, climate-smart choices that support economic development and protect lives and property. NOAA offers extensive education, outreach, and technical assistance to a broad suite of local, state, and regional partners, through efforts and programs such as our Regional Climate Services, Sea Grant Program, Climate Adaptation Partnerships [formerly known as

Regional Integrated Sciences and Assessments (RISA)], Climate Smart Communities Initiative, IOOS Regional Associations, Fisheries Science Centers, National Coastal Zone Management Program and others. Through these programs, NOAA builds and leverages trusted relationships to identify what users need and to help them to find and use dispersed federal resources.

For instance, NOAA's Climate Adaptation Partnerships (previously known as RISAs) provides tailored tools within a region that are targeted toward sets of decision-makers such as emergency managers, hazard mitigation planners, or public health agencies that curate and incorporate a range of information about relevant climate risks from a set of federal and local data sources (e.g. across agencies, research institutions). In addition, NOAA's Weather Forecast Offices engage with local communities and local officials to help them better understand what federal information is available on local hydrology and floodplain risks and how best to apply these resources, which enhances their preparedness for extreme weather, water, and climate events.

Through programs like these, NOAA is committed to continuously improving our understanding of the needs of local communities, especially those that are most vulnerable and least well equipped to deal with climate impacts, such as small towns with limited resources.

At the same time, NOAA is committed to continuing to work in partnership with other Federal agencies to make climate data and information easier to find and use in the future. For instance, NOAA is continuously improving Climate.gov, which provides timely and authoritative scientific data and information about climate science, adaptation, and mitigation and incorporates data and information from other federal agencies.

NOAA's long-standing partnership with the nation's State Climatologists helps make authoritative information more available at the local level. For example, just south of Rep. Sherrill's district, the NJ State Climate Office (NJSCO), based at Rutgers and led by David Robinson, is a key partner in helping translate and transform NOAA data into actionable information that speaks to New Jersey's issues. If you click on the "featured products" listed by the NJSCO, three of them come from NOAA's National Centers for Environmental Information. The NJSCO helps contextualize it in a way that works for New Jersey, and from an institution that New Jerseyans' trust. The NJSCO also supplements NOAA/NCEI data with their own, even more, local data, from the state-run "mesonet." The NJ Mesonet shares tips and techniques with other state-run mesonets, through the American Association of State Climatologists, chartered in Asheville and co-located with NCEI, a heritage of the 45 years of operational side-by-side, arm-in-arm partnership NCEI maintains with its state partners.

b. **Can you explain how a centralized single stop-stop planning tool that pulls climate information and solutions from all agencies may be better for underresourced communities than having to go to each different agency's climate data and solutions platform(s)?**

While a one-stop-shop is not a panacea, a robust information website can be a key tool in navigating different sources of data.

One of the best examples is the interagency U.S. Climate Resilience Toolkit (CRT), mentioned in the previous answer, which was designed and developed to help decision-makers at all levels of government, businesses, community leaders, and managers of natural and built environments understand their climate-related risks; and to help them produce and implement a climate resilience plan. The site offers regional and topical information excerpted from the U.S. National Climate Assessment (and other authoritative sources), a compendium of free tools from across the Federal government, a library of real-world case studies, a mapping and graphing tool for exploring county-scale climate projections (the Climate Explorer), and a "Steps to Resilience" framework to help guide people through the process of producing and implementing a resilience plan.

However, the USCRT has not yet reached its full potential. A key goal of the USCRT is to make it easy and efficient for communities all across the nation, including those that are under-resourced, to find and integrate Federal decision-relevant climate and non-climate data together with their own local data for planning and decision-making purposes. Yet, most U.S. municipal governments do not have Geographical Information System (GIS) expertise on staff. To address this need, NOAA is working with a group of other agencies through the U.S. Global Change Research Program (USGCRP) and the Federal Geographic Data Committee (FGDC) on ways to improve climate information systems. An improved system will further help all Americans (including government leaders at all levels, managers of natural resources and built infrastructure, municipal planners, and public and private decision-makers) access U.S. Federal data in a format that facilitates easy integration with their own local data to help them understand and manage their climate-related risks and opportunities.

NOAA recognizes that while better integration of data and tools is always helpful, it's critical that we continue to focus on connecting directly with underserved and under-represented communities to ensure we understand their needs for our data and tools. Many communities do not have the resources or expertise to locate, understand, analyze, interpret, and integrate U.S. Federal data and use it together with their own local data for planning and decision-making purposes. It

may not be sufficient to simply provide the information, even if it is a one-stop shop.

Under-resourced communities need additional capacity to identify, navigate, and apply climate information tools. Since tools were developed to address specific challenges, the Federal government could better pull together information about specific communities from a variety of tools, resulting in a broad landscape understanding of the challenges that need to be addressed (e.g., environmental justice considerations, climate change threats, etc.). The U.S. Climate Resilience Toolkit and other resources provide a starting point for a more in-depth and focused conversation with members of the community about the on-the-ground challenges and what capacities the Federal government has to address them.

Responses by Ms. Ingrid Kolb

U.S. HOUSE OF REPRESENTATIVES COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

Questions for the Record to:

Ms. Ingrid Kolb

Director Office of Management

Department of Energy

QUESTIONS SUBMITTED BY RANKING MEMBER FRANK LUCAS

Q1. Members of the Committee posed questions on the Department of Energy's (DOE's) recently announced "Clean Energy Corps" but seek additional details on this initiative.

Q1a. DOE has stated that it plans to hire an additional 1,000 employees. How did DOE determine the number of additional employees that would be needed? Is this number flexible, and does DOE plan to reassess this number at any point?

A1a. This number is an approximate figure based on an assessment of the staff required to implement the various provisions of the Bipartisan Infrastructure Law (BIL). This number is flexible and will be assessed regularly as implementation of the BIL progresses.

Q1b. Has DOE identified specific positions that it will attempt to fill? If so, how many of these positions have been identified? How will the filling of these specific positions be prioritized?

A1b. The 1,000-position number was estimated to implement the various BIL provisions and includes a variety of positions including engineering, procurement, legal, financial and other areas of required expertise to alleviate the burden on programmatic staff. Prioritization is based around time-constraints of provisions as mandated by Congress and based on how provisions will be administered—i.e., program design and implementation will be prioritized before applicant evaluation and project execution.

Q1c. Please describe DOE's process for assessing its existing workforce and pinpointing DOE's needs for new employees? Which officials or employees participated in this task?

A1c. Following enactment of the BIL, each departmental element formulated an initial staffing plan which identified new staffing needs in addition to the existing workforce in line with

the program direction funding levels enacted in the BIL. It is important to note that many of the departmental elements are already currently understaffed in addressing the yearly congressionally mandated appropriation requirements, so recruitment of additional BIL staff is a departmental priority. Staffing plans were reviewed with DOE leadership and recruitment priorities were established. Staffing plans are continuing to be refined and aligned to budget availability.

Q1d. Has DOE consulted with other federal agencies with related missions to avoid establishing duplicative positions or to determine opportunities to utilize existing expertise of current federal employees?

A1d. Yes. Many of the BIL provisions involve consultation with other federal agencies—Interior, EPA, Treasury, Labor, Commerce and others—to ensure that the BIL funding is utilized in a way to maximize value to the taxpayer, industry, academia, the National Laboratory complex, and all shareholders and stakeholders. DOE has numerous existing agreements in place with these agencies and coordinates regularly to avoid duplication of effort and utilize their valued inherent knowledge in their various areas of expertise.

U.S. HOUSE OF REPRESENTATIVES COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

Questions for the Record to:

Ms. Ingrid Kolb

Director Office of Management

Department of Energy

QUESTIONS SUBMITTED BY REPRESENTATIVE RANDY WEBER

Q1. As I mentioned in the hearing, Texas had a severe winter weather event that caused transmission and operation issues related to multiple energy sources. This exposed a flaw that I have warned about for years: focusing too much on unreliable sources leaves us exposed to major outages.

Q1a. As DOE sets ambitious goals on using renewable energy to power many of their facilities and laboratories, how is the Department ensuring that reliable energy sources are still available for many critical and national security functions?

A1a. DOE recognizes that its mission is performed in an already changing climate, and that its facilities and operations are subject to the impacts of climate change. In response, DOE has developed and is implementing the Department's 2021 Climate Adaptation and Resilience Plan (Plan) with key strategies to adapt and respond to extreme weather threats by increasing our resilience and ensuring reliable energy sources are available for our critical and national security functions. For example, the Department is in the process of updating its assessment of climate vulnerabilities at each DOE site and will identify resilience actions for those sites by September 2022. These resilience plans will address a range of potential extreme weather impacts across the DOE complex, including vulnerabilities to major power outages, and will identify actions to enhance resilience, such as reinforcing energy assets vulnerable to wind and ice damage and providing backup power generation and battery storage to address power outages.

Responses by Dr. Joel Carney

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
Questions for the Record to:
Dr. Joel Carney
Assistant Administrator, Office of Strategic Infrastructure
National Aeronautics and Space Administration
Submitted by Representative Susan Wild

1. For the record, I would like to follow up on my question from the hearing regarding the use of more sustainable building materials. Portland-limestone cement replaces traditional cement on a 1:1 basis and produces concrete with equivalent performance but with a carbon footprint that is up to ten percent lower than non-PLC alternatives.

   a. In order to achieve our nation's climate goals, how has or can GSA utilize lower-carbon building materials like Portland-limestone cement in its past, current, and future projects?

NASA Response:

NASA respectfully refers the Committee to GSA for a response to this QFR.

Under NASA's own construction authorities, NASA updated its facilities guide specifications in 2021 to allow for the usage of Portland Limestone Cement within concrete. This updated guide, along with the agency's ongoing commitment to sustainable practices such as Leadership in Energy and Environmental Design (LEED), further expanded NASA's move towards sustainable, climate-friendly construction practices.

   b. What obstacles or issues has GSA encountered in using these materials or could it encounter for future projects that Congress should consider?

NASA Response:

NASA respectfully refers the Committee to GSA for a response to this QFR.

Under NASA's own construction authorities, NASA has been working with the construction industry over the last few decades to optimize our construction practices with respect to achieving national climate goals. Current concerns, related to concrete containing Portland Limestone cement, that may impact future NASA projects include structural performance measures such as compressive strength, workability, and durability of the concrete.

Responses by Mr. Alfredo Gomez

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

Questions for the Record to:
Mr. Alfredo Gomez
Director, Natural Resources and Environment
Government Accountability Office
Submitted by Representative Susan Wild

1. **For the record, I would like to follow up on my question from the hearing regarding the use of more sustainable building materials. Portland-limestone cement replaces traditional cement on a 1:1 basis and produces concrete with equivalent performance but with a carbon footprint that is up to ten percent lower than non-PLC alternatives.**

   a. **In order to achieve our nation's climate goals, how has or can GSA utilize lower-carbon building materials like Portland-limestone cement in its past, current, and future projects?**

   b. **What obstacles or issues has GSA encountered in using these materials or could it encounter for future projects that Congress should consider?**

We have not evaluated GSA's use of specific building materials to help meet U.S. climate goals. As a result, we cannot comment on what obstacles exist to the use of portland-limestone cement in projects sponsored by GSA. However, we have reported on governmentwide efforts to account for climate change in the practices and procedures that influence how infrastructure is planned and constructed.

Specifically, in November 2016, we issued *Climate Change: Improved Federal Coordination Could Facilitate Use of Forward-Looking Climate Information in Design Standards, Building Codes, and Certifications* (GAO-17-3). In the report, we found that standards-developing organizations face institutional and technical challenges to using the best available forward-looking climate information in design standards, building codes, and voluntary certifications. We also found that agencies that address climate issues could improve interagency coordination, and provide the best available forward-looking climate information to help standards-developing organizations address their institutional and technical challenges. We recommended that the Department of Commerce, through the National Institute of Science and Technology, and in consultation with the U.S. Global Change Research Program and the Mitigation Framework Leadership Group, convene an ongoing government-wide effort to provide forward-looking climate information to standards organizations. As of February 2022, the National Institute of Science and Technology has not implemented our recommendation.

Appendix II

Additional Material for the Record

DOCUMENT SUBMITTED BY REPRESENTATIVE BILL POSEY

Federal Register / Vol. 86, No. 19 / Monday, February 1, 2021 / Presidential Documents 7619

Presidential Documents

Executive Order 14008 of January 27, 2021

Tackling the Climate Crisis at Home and Abroad

The United States and the world face a profound climate crisis. We have a narrow moment to pursue action at home and abroad in order to avoid the most catastrophic impacts of that crisis and to seize the opportunity that tackling climate change presents. Domestic action must go hand in hand with United States international leadership, aimed at significantly enhancing global action. Together, we must listen to science and meet the moment.

By the authority vested in me as President by the Constitution and the laws of the United States of America, it is hereby ordered as follows:

PART I—PUTTING THE CLIMATE CRISIS AT THE CENTER OF UNITED STATES FOREIGN POLICY AND NATIONAL SECURITY

Section 101. *Policy*. United States international engagement to address climate change—which has become a climate crisis—is more necessary and urgent than ever. The scientific community has made clear that the scale and speed of necessary action is greater than previously believed. There is little time left to avoid setting the world on a dangerous, potentially catastrophic, climate trajectory. Responding to the climate crisis will require both significant short-term global reductions in greenhouse gas emissions and net-zero global emissions by mid-century or before.

It is the policy of my Administration that climate considerations shall be an essential element of United States foreign policy and national security. The United States will work with other countries and partners, both bilaterally and multilaterally, to put the world on a sustainable climate pathway. The United States will also move quickly to build resilience, both at home and abroad, against the impacts of climate change that are already manifest and will continue to intensify according to current trajectories.

Sec. 102. *Purpose*. This order builds on and reaffirms actions my Administration has already taken to place the climate crisis at the forefront of this Nation's foreign policy and national security planning, including submitting the United States instrument of acceptance to rejoin the Paris Agreement. In implementing—and building upon—the Paris Agreement's three overarching objectives (a safe global temperature, increased climate resilience, and financial flows aligned with a pathway toward low greenhouse gas emissions and climate-resilient development), the United States will exercise its leadership to promote a significant increase in global climate ambition to meet the climate challenge. In this regard:

(a) I will host an early Leaders' Climate Summit aimed at raising climate ambition and making a positive contribution to the 26th United Nations Climate Change Conference of the Parties (COP26) and beyond.

(b) The United States will reconvene the Major Economies Forum on Energy and Climate, beginning with the Leaders' Climate Summit. In cooperation with the members of that Forum, as well as with other partners as appropriate, the United States will pursue green recovery efforts, initiatives to advance the clean energy transition, sectoral decarbonization, and alignment of financial flows with the objectives of the Paris Agreement, including with respect to coal financing, nature-based solutions, and solutions to other climate-related challenges.

(c) I have created a new Presidentially appointed position, the Special Presidential Envoy for Climate, to elevate the issue of climate change and underscore the commitment my Administration will make toward addressing it.

(d) Recognizing that climate change affects a wide range of subjects, it will be a United States priority to press for enhanced climate ambition and integration of climate considerations across a wide range of international fora, including the Group of Seven (G7), the Group of Twenty (G20), and fora that address clean energy, aviation, shipping, the Arctic, the ocean, sustainable development, migration, and other relevant topics. The Special Presidential Envoy for Climate and others, as appropriate, are encouraged to promote innovative approaches, including international multi-stakeholder initiatives. In addition, my Administration will work in partnership with States, localities, Tribes, territories, and other United States stakeholders to advance United States climate diplomacy.

(e) The United States will immediately begin the process of developing its nationally determined contribution under the Paris Agreement. The process will include analysis and input from relevant executive departments and agencies (agencies), as well as appropriate outreach to domestic stakeholders. The United States will aim to submit its nationally determined contribution in advance of the Leaders' Climate Summit.

(f) The United States will also immediately begin to develop a climate finance plan, making strategic use of multilateral and bilateral channels and institutions, to assist developing countries in implementing ambitious emissions reduction measures, protecting critical ecosystems, building resilience against the impacts of climate change, and promoting the flow of capital toward climate-aligned investments and away from high-carbon investments. The Secretary of State and the Secretary of the Treasury, in coordination with the Special Presidential Envoy for Climate, shall lead a process to develop this plan, with the participation of the Administrator of the United States Agency for International Development (USAID), the Chief Executive Officer of the United States International Development Finance Corporation (DFC), the Chief Executive Officer of the Millennium Challenge Corporation, the Director of the United States Trade and Development Agency, the Director of the Office of Management and Budget, and the head of any other agency providing foreign assistance and development financing, as appropriate. The Secretary of State and the Secretary of the Treasury shall submit the plan to the President, through the Assistant to the President for National Security Affairs and the Assistant to the President for Economic Policy, within 90 days of the date of this order.

(g) The Secretary of the Treasury shall:

(i) ensure that the United States is present and engaged in relevant international fora and institutions that are working on the management of climate-related financial risks;

(ii) develop a strategy for how the voice and vote of the United States can be used in international financial institutions, including the World Bank Group and the International Monetary Fund, to promote financing programs, economic stimulus packages, and debt relief initiatives that are aligned with and support the goals of the Paris Agreement; and

(iii) develop, in collaboration with the Secretary of State, the Administrator of USAID, and the Chief Executive Officer of the DFC, a plan for promoting the protection of the Amazon rainforest and other critical ecosystems that serve as global carbon sinks, including through market-based mechanisms.

(h) The Secretary of State, the Secretary of the Treasury, and the Secretary of Energy shall work together and with the Export-Import Bank of the United States, the Chief Executive Officer of the DFC, and the heads of other agencies and partners, as appropriate, to identify steps through which the United States can promote ending international financing of carbon-

intensive fossil fuel-based energy while simultaneously advancing sustainable development and a green recovery, in consultation with the Assistant to the President for National Security Affairs.

(i) The Secretary of Energy, in cooperation with the Secretary of State and the heads of other agencies, as appropriate, shall identify steps through which the United States can intensify international collaborations to drive innovation and deployment of clean energy technologies, which are critical for climate protection.

(j) The Secretary of State shall prepare, within 60 days of the date of this order, a transmittal package seeking the Senate's advice and consent to ratification of the Kigali Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, regarding the phasedown of the production and consumption of hydrofluorocarbons.

Sec. 103. *Prioritizing Climate in Foreign Policy and National Security.* To ensure that climate change considerations are central to United States foreign policy and national security:

(a) Agencies that engage in extensive international work shall develop, in coordination with the Special Presidential Envoy for Climate, and submit to the President, through the Assistant to the President for National Security Affairs, within 90 days of the date of this order, strategies and implementation plans for integrating climate considerations into their international work, as appropriate and consistent with applicable law. These strategies and plans should include an assessment of:

(i) climate impacts relevant to broad agency strategies in particular countries or regions;

(ii) climate impacts on their agency-managed infrastructure abroad (e.g., embassies, military installations), without prejudice to existing requirements regarding assessment of such infrastructure;

(iii) how the agency intends to manage such impacts or incorporate risk mitigation into its installation master plans; and

(iv) how the agency's international work, including partner engagement, can contribute to addressing the climate crisis.

(b) The Director of National Intelligence shall prepare, within 120 days of the date of this order, a National Intelligence Estimate on the national and economic security impacts of climate change.

(c) The Secretary of Defense, in coordination with the Secretary of Commerce, through the Administrator of the National Oceanic and Atmospheric Administration, the Chair of the Council on Environmental Quality, the Administrator of the Environmental Protection Agency, the Director of National Intelligence, the Director of the Office of Science and Technology Policy, the Administrator of the National Aeronautics and Space Administration, and the heads of other agencies as appropriate, shall develop and submit to the President, within 120 days of the date of this order, an analysis of the security implications of climate change (Climate Risk Analysis) that can be incorporated into modeling, simulation, war-gaming, and other analyses.

(d) The Secretary of Defense and the Chairman of the Joint Chiefs of Staff shall consider the security implications of climate change, including any relevant information from the Climate Risk Analysis described in subsection (c) of this section, in developing the National Defense Strategy, Defense Planning Guidance, Chairman's Risk Assessment, and other relevant strategy, planning, and programming documents and processes. Starting in January 2022, the Secretary of Defense and the Chairman of the Joint Chiefs of Staff shall provide an annual update, through the National Security Council, on the progress made in incorporating the security implications of climate change into these documents and processes.

(e) The Secretary of Homeland Security shall consider the implications of climate change in the Arctic, along our Nation's borders, and to National

Critical Functions, including any relevant information from the Climate Risk Analysis described in subsection (c) of this section, in developing relevant strategy, planning, and programming documents and processes. Starting in January 2022, the Secretary of Homeland Security shall provide an annual update, through the National Security Council, on the progress made in incorporating the homeland security implications of climate change into these documents and processes.

Sec. 104. *Reinstatement.* The Presidential Memorandum of September 21, 2016 (Climate Change and National Security), is hereby reinstated.

PART II—TAKING A GOVERNMENT-WIDE APPROACH TO THE CLIMATE CRISIS

Sec. 201. *Policy.* Even as our Nation emerges from profound public health and economic crises borne of a pandemic, we face a climate crisis that threatens our people and communities, public health and economy, and, starkly, our ability to live on planet Earth. Despite the peril that is already evident, there is promise in the solutions—opportunities to create well-paying union jobs to build a modern and sustainable infrastructure, deliver an equitable, clean energy future, and put the United States on a path to achieve net-zero emissions, economy-wide, by no later than 2050.

We must listen to science—and act. We must strengthen our clean air and water protections. We must hold polluters accountable for their actions. We must deliver environmental justice in communities all across America. The Federal Government must drive assessment, disclosure, and mitigation of climate pollution and climate-related risks in every sector of our economy, marshaling the creativity, courage, and capital necessary to make our Nation resilient in the face of this threat. Together, we must combat the climate crisis with bold, progressive action that combines the full capacity of the Federal Government with efforts from every corner of our Nation, every level of government, and every sector of our economy.

It is the policy of my Administration to organize and deploy the full capacity of its agencies to combat the climate crisis to implement a Government-wide approach that reduces climate pollution in every sector of the economy; increases resilience to the impacts of climate change; protects public health; conserves our lands, waters, and biodiversity; delivers environmental justice; and spurs well-paying union jobs and economic growth, especially through innovation, commercialization, and deployment of clean energy technologies and infrastructure. Successfully meeting these challenges will require the Federal Government to pursue such a coordinated approach from planning to implementation, coupled with substantive engagement by stakeholders, including State, local, and Tribal governments.

Sec. 202. *White House Office of Domestic Climate Policy.* There is hereby established the White House Office of Domestic Climate Policy (Climate Policy Office) within the Executive Office of the President, which shall coordinate the policy-making process with respect to domestic climate-policy issues; coordinate domestic climate-policy advice to the President; ensure that domestic climate-policy decisions and programs are consistent with the President's stated goals and that those goals are being effectively pursued; and monitor implementation of the President's domestic climate-policy agenda. The Climate Policy Office shall have a staff headed by the Assistant to the President and National Climate Advisor (National Climate Advisor) and shall include the Deputy Assistant to the President and Deputy National Climate Advisor. The Climate Policy Office shall have such staff and other assistance as may be necessary to carry out the provisions of this order, subject to the availability of appropriations, and may work with established or ad hoc committees or interagency groups. All agencies shall cooperate with the Climate Policy Office and provide such information, support, and assistance to the Climate Policy Office as it may request, as appropriate and consistent with applicable law.

Sec. 203. *National Climate Task Force*. There is hereby established a National Climate Task Force (Task Force). The Task Force shall be chaired by the National Climate Advisor.

(a) Membership. The Task Force shall consist of the following additional members:

(i) the Secretary of the Treasury;

(ii) the Secretary of Defense;

(iii) the Attorney General;

(iv) the Secretary of the Interior;

(v) the Secretary of Agriculture;

(vi) the Secretary of Commerce;

(vii) the Secretary of Labor;

(viii) the Secretary of Health and Human Services;

(ix) the Secretary of Housing and Urban Development;

(x) the Secretary of Transportation;

(xi) the Secretary of Energy;

(xii) the Secretary of Homeland Security;

(xiii) the Administrator of General Services;

(xiv) the Chair of the Council on Environmental Quality;

(xv) the Administrator of the Environmental Protection Agency;

(xvi) the Director of the Office of Management and Budget;

(xvii) the Director of the Office of Science and Technology Policy;

(xviii) the Assistant to the President for Domestic Policy;

(xix) the Assistant to the President for National Security Affairs;

(xx) the Assistant to the President for Homeland Security and Counterterrorism; and

(xxi) the Assistant to the President for Economic Policy.

(b) Mission and Work. The Task Force shall facilitate the organization and deployment of a Government-wide approach to combat the climate crisis. This Task Force shall facilitate planning and implementation of key Federal actions to reduce climate pollution; increase resilience to the impacts of climate change; protect public health; conserve our lands, waters, oceans, and biodiversity; deliver environmental justice; and spur well-paying union jobs and economic growth. As necessary and appropriate, members of the Task Force will engage on these matters with State, local, Tribal, and territorial governments; workers and communities; and leaders across the various sectors of our economy.

(c) Prioritizing Actions. To the extent permitted by law, Task Force members shall prioritize action on climate change in their policy-making and budget processes, in their contracting and procurement, and in their engagement with State, local, Tribal, and territorial governments; workers and communities; and leaders across all the sectors of our economy.

USE OF THE FEDERAL GOVERNMENT'S BUYING POWER AND REAL PROPERTY AND ASSET MANAGEMENT

Sec. 204. *Policy*. It is the policy of my Administration to lead the Nation's effort to combat the climate crisis by example—specifically, by aligning the management of Federal procurement and real property, public lands and waters, and financial programs to support robust climate action. By providing an immediate, clear, and stable source of product demand, increased transparency and data, and robust standards for the market, my Administration will help to catalyze private sector investment into, and

accelerate the advancement of America's industrial capacity to supply, domestic clean energy, buildings, vehicles, and other necessary products and materials.

Sec. 205. *Federal Clean Electricity and Vehicle Procurement Strategy.* (a) The Chair of the Council on Environmental Quality, the Administrator of General Services, and the Director of the Office and Management and Budget, in coordination with the Secretary of Commerce, the Secretary of Labor, the Secretary of Energy, and the heads of other relevant agencies, shall assist the National Climate Advisor, through the Task Force established in section 203 of this order, in developing a comprehensive plan to create good jobs and stimulate clean energy industries by revitalizing the Federal Government's sustainability efforts.

(b) The plan shall aim to use, as appropriate and consistent with applicable law, all available procurement authorities to achieve or facilitate:

(i) a carbon pollution-free electricity sector no later than 2035; and

(ii) clean and zero-emission vehicles for Federal, State, local, and Tribal government fleets, including vehicles of the United States Postal Service.

(c) If necessary, the plan shall recommend any additional legislation needed to accomplish these objectives.

(d) The plan shall also aim to ensure that the United States retains the union jobs integral to and involved in running and maintaining clean and zero-emission fleets, while spurring the creation of union jobs in the manufacture of those new vehicles. The plan shall be submitted to the Task Force within 90 days of the date of this order.

Sec. 206. *Procurement Standards.* Consistent with the Executive Order of January 25, 2021, entitled, "Ensuring the Future Is Made in All of America by All of America's Workers," agencies shall adhere to the requirements of the Made in America Laws in making clean energy, energy efficiency, and clean energy procurement decisions. Agencies shall, consistent with applicable law, apply and enforce the Davis-Bacon Act and prevailing wage and benefit requirements. The Secretary of Labor shall take steps to update prevailing wage requirements. The Chair of the Council on Environmental Quality shall consider additional administrative steps and guidance to assist the Federal Acquisition Regulatory Council in developing regulatory amendments to promote increased contractor attention on reduced carbon emission and Federal sustainability.

Sec. 207. *Renewable Energy on Public Lands and in Offshore Waters.* The Secretary of the Interior shall review siting and permitting processes on public lands and in offshore waters to identify to the Task Force steps that can be taken, consistent with applicable law, to increase renewable energy production on those lands and in those waters, with the goal of doubling offshore wind by 2030 while ensuring robust protection for our lands, waters, and biodiversity and creating good jobs. In conducting this review, the Secretary of the Interior shall consult, as appropriate, with the heads of relevant agencies, including the Secretary of Defense, the Secretary of Agriculture, the Secretary of Commerce, through the Administrator of the National Oceanic and Atmospheric Administration, the Secretary of Energy, the Chair of the Council on Environmental Quality, State and Tribal authorities, project developers, and other interested parties. The Secretary of the Interior shall engage with Tribal authorities regarding the development and management of renewable and conventional energy resources on Tribal lands.

Sec. 208. *Oil and Natural Gas Development on Public Lands and in Offshore Waters.* To the extent consistent with applicable law, the Secretary of the Interior shall pause new oil and natural gas leases on public lands or in offshore waters pending completion of a comprehensive review and reconsideration of Federal oil and gas permitting and leasing practices in light of the Secretary of the Interior's broad stewardship responsibilities over the public lands and in offshore waters, including potential climate and

other impacts associated with oil and gas activities on public lands or in offshore waters. The Secretary of the Interior shall complete that review in consultation with the Secretary of Agriculture, the Secretary of Commerce, through the National Oceanic and Atmospheric Administration, and the Secretary of Energy. In conducting this analysis, and to the extent consistent with applicable law, the Secretary of the Interior shall consider whether to adjust royalties associated with coal, oil, and gas resources extracted from public lands and offshore waters, or take other appropriate action, to account for corresponding climate costs.

Sec. 209. *Fossil Fuel Subsidies.* The heads of agencies shall identify for the Director of the Office of Management and Budget and the National Climate Advisor any fossil fuel subsidies provided by their respective agencies, and then take steps to ensure that, to the extent consistent with applicable law, Federal funding is not directly subsidizing fossil fuels. The Director of the Office of Management and Budget shall seek, in coordination with the heads of agencies and the National Climate Advisor, to eliminate fossil fuel subsidies from the budget request for Fiscal Year 2022 and thereafter.

Sec. 210. *Clean Energy in Financial Management.* The heads of agencies shall identify opportunities for Federal funding to spur innovation, commercialization, and deployment of clean energy technologies and infrastructure for the Director of the Office of Management and Budget and the National Climate Advisor, and then take steps to ensure that, to the extent consistent with applicable law, Federal funding is used to spur innovation, commercialization, and deployment of clean energy technologies and infrastructure. The Director of the Office of Management and Budget, in coordination with agency heads and the National Climate Advisor, shall seek to prioritize such investments in the President's budget request for Fiscal Year 2022 and thereafter.

Sec. 211. *Climate Action Plans and Data and Information Products to Improve Adaptation and Increase Resilience.* (a) The head of each agency shall submit a draft action plan to the Task Force and the Federal Chief Sustainability Officer within 120 days of the date of this order that describes steps the agency can take with regard to its facilities and operations to bolster adaptation and increase resilience to the impacts of climate change. Action plans should, among other things, describe the agency's climate vulnerabilities and describe the agency's plan to use the power of procurement to increase the energy and water efficiency of United States Government installations, buildings, and facilities and ensure they are climate-ready. Agencies shall consider the feasibility of using the purchasing power of the Federal Government to drive innovation, and shall seek to increase the Federal Government's resilience against supply chain disruptions. Such disruptions put the Nation's manufacturing sector at risk, as well as consumer access to critical goods and services. Agencies shall make their action plans public, and post them on the agency website, to the extent consistent with applicable law.

(b) Within 30 days of an agency's submission of an action plan, the Federal Chief Sustainability Officer, in coordination with the Director of the Office of Management and Budget, shall review the plan to assess its consistency with the policy set forth in section 204 of this order and the priorities issued by the Office of Management and Budget.

(c) After submitting an initial action plan, the head of each agency shall submit to the Task Force and Federal Chief Sustainability Officer progress reports annually on the status of implementation efforts. Agencies shall make progress reports public and post them on the agency website, to the extent consistent with applicable law. The heads of agencies shall assign their respective agency Chief Sustainability Officer the authority to perform duties relating to implementation of this order within the agency, to the extent consistent with applicable law.

(d) To assist agencies and State, local, Tribal, and territorial governments, communities, and businesses in preparing for and adapting to the impacts of climate change, the Secretary of Commerce, through the Administrator

of the National Oceanic and Atmospheric Administration, the Secretary of Homeland Security, through the Administrator of the Federal Emergency Management Agency, and the Director of the Office of Science and Technology Policy, in coordination with the heads of other agencies, as appropriate, shall provide to the Task Force a report on ways to expand and improve climate forecast capabilities and information products for the public. In addition, the Secretary of the Interior and the Deputy Director for Management of the Office of Management and Budget, in their capacities as the Chair and Vice-Chair of the Federal Geographic Data Committee, shall assess and provide to the Task Force a report on the potential development of a consolidated Federal geographic mapping service that can facilitate public access to climate-related information that will assist Federal, State, local, and Tribal governments in climate planning and resilience activities.

EMPOWERING WORKERS THROUGH REBUILDING OUR INFRASTRUCTURE FOR A SUSTAINABLE ECONOMY

Sec. 212. *Policy*. This Nation needs millions of construction, manufacturing, engineering, and skilled-trades workers to build a new American infrastructure and clean energy economy. These jobs will create opportunities for young people and for older workers shifting to new professions, and for people from all backgrounds and communities. Such jobs will bring opportunity to communities too often left behind—places that have suffered as a result of economic shifts and places that have suffered the most from persistent pollution, including low-income rural and urban communities, communities of color, and Native communities.

Sec. 213. *Sustainable Infrastructure*. (a) The Chair of the Council on Environmental Quality and the Director of the Office of Management and Budget shall take steps, consistent with applicable law, to ensure that Federal infrastructure investment reduces climate pollution, and to require that Federal permitting decisions consider the effects of greenhouse gas emissions and climate change. In addition, they shall review, and report to the National Climate Advisor on, siting and permitting processes, including those in progress under the auspices of the Federal Permitting Improvement Steering Council, and identify steps that can be taken, consistent with applicable law, to accelerate the deployment of clean energy and transmission projects in an environmentally stable manner.

(b) Agency heads conducting infrastructure reviews shall, as appropriate, consult from an early stage with State, local, and Tribal officials involved in permitting or authorizing proposed infrastructure projects to develop efficient timelines for decision-making that are appropriate given the complexities of proposed projects.

EMPOWERING WORKERS BY ADVANCING CONSERVATION, AGRICULTURE, AND REFORESTATION

Sec. 214. *Policy*. It is the policy of my Administration to put a new generation of Americans to work conserving our public lands and waters. The Federal Government must protect America's natural treasures, increase reforestation, improve access to recreation, and increase resilience to wildfires and storms, while creating well-paying union jobs for more Americans, including more opportunities for women and people of color in occupations where they are underrepresented. America's farmers, ranchers, and forest landowners have an important role to play in combating the climate crisis and reducing greenhouse gas emissions, by sequestering carbon in soils, grasses, trees, and other vegetation and sourcing sustainable bioproducts and fuels. Coastal communities have an essential role to play in mitigating climate change and strengthening resilience by protecting and restoring coastal ecosystems, such as wetlands, seagrasses, coral and oyster reefs, and mangrove and kelp forests, to protect vulnerable coastlines, sequester carbon, and support biodiversity and fisheries.

Sec. 215. *Civilian Climate Corps*. In furtherance of the policy set forth in section 214 of this order, the Secretary of the Interior, in collaboration with the Secretary of Agriculture and the heads of other relevant agencies,

shall submit a strategy to the Task Force within 90 days of the date of this order for creating a Civilian Climate Corps Initiative, within existing appropriations, to mobilize the next generation of conservation and resilience workers and maximize the creation of accessible training opportunities and good jobs. The initiative shall aim to conserve and restore public lands and waters, bolster community resilience, increase reforestation, increase carbon sequestration in the agricultural sector, protect biodiversity, improve access to recreation, and address the changing climate.

Sec. 216. *Conserving Our Nation's Lands and Waters.* (a) The Secretary of the Interior, in consultation with the Secretary of Agriculture, the Secretary of Commerce, the Chair of the Council on Environmental Quality, and the heads of other relevant agencies, shall submit a report to the Task Force within 90 days of the date of this order recommending steps that the United States should take, working with State, local, Tribal, and territorial governments, agricultural and forest landowners, fishermen, and other key stakeholders, to achieve the goal of conserving at least 30 percent of our lands and waters by 2030.

(i) The Secretary of the Interior, the Secretary of Agriculture, the Secretary of Commerce, through the Administrator of the National Oceanic and Atmospheric Administration, and the Chair of the Council on Environmental Quality shall, as appropriate, solicit input from State, local, Tribal, and territorial officials, agricultural and forest landowners, fishermen, and other key stakeholders in identifying strategies that will encourage broad participation in the goal of conserving 30 percent of our lands and waters by 2030.

(ii) The report shall propose guidelines for determining whether lands and waters qualify for conservation, and it also shall establish mechanisms to measure progress toward the 30-percent goal. The Secretary of the Interior shall subsequently submit annual reports to the Task Force to monitor progress.

(b) The Secretary of Agriculture shall:

(i) initiate efforts in the first 60 days from the date of this order to collect input from Tribes, farmers, ranchers, forest owners, conservation groups, firefighters, and other stakeholders on how to best use Department of Agriculture programs, funding and financing capacities, and other authorities, and how to encourage the voluntary adoption of climate-smart agricultural and forestry practices that decrease wildfire risk fueled by climate change and result in additional, measurable, and verifiable carbon reductions and sequestration and that source sustainable bioproducts and fuels; and

(ii) submit to the Task Force within 90 days of the date of this order a report making recommendations for an agricultural and forestry climate strategy.

(c) The Secretary of Commerce, through the Administrator of the National Oceanic and Atmospheric Administration, shall initiate efforts in the first 60 days from the date of this order to collect input from fishermen, regional ocean councils, fishery management councils, scientists, and other stakeholders on how to make fisheries and protected resources more resilient to climate change, including changes in management and conservation measures, and improvements in science, monitoring, and cooperative research.

EMPOWERING WORKERS THROUGH REVITALIZING ENERGY COMMUNITIES

Sec. 217. *Policy.* It is the policy of my Administration to improve air and water quality and to create well-paying union jobs and more opportunities for women and people of color in hard-hit communities, including rural communities, while reducing methane emissions, oil and brine leaks, and other environmental harms from tens of thousands of former mining and well sites. Mining and power plant workers drove the industrial revolution and the economic growth that followed, and have been essential to the growth of the United States. As the Nation shifts to a clean energy economy,

Federal leadership is essential to foster economic revitalization of and investment in these communities, ensure the creation of good jobs that provide a choice to join a union, and secure the benefits that have been earned by workers.

Such work should include projects that reduce emissions of toxic substances and greenhouse gases from existing and abandoned infrastructure and that prevent environmental damage that harms communities and poses a risk to public health and safety. Plugging leaks in oil and gas wells and reclaiming abandoned mine land can create well-paying union jobs in coal, oil, and gas communities while restoring natural assets, revitalizing recreation economies, and curbing methane emissions. In addition, such work should include efforts to turn properties idled in these communities, such as brownfields, into new hubs for the growth of our economy. Federal agencies should therefore coordinate investments and other efforts to assist coal, oil and gas, and power plant communities, and achieve substantial reductions of methane emissions from the oil and gas sector as quickly as possible.

Sec. 218. *Interagency Working Group on Coal and Power Plant Communities and Economic Revitalization.* There is hereby established an Interagency Working Group on Coal and Power Plant Communities and Economic Revitalization (Interagency Working Group). The National Climate Advisor and the Assistant to the President for Economic Policy shall serve as Co-Chairs of the Interagency Working Group.

(a) Membership. The Interagency Working Group shall consist of the following additional members:

(i) the Secretary of the Treasury;

(ii) the Secretary of the Interior;

(iii) the Secretary of Agriculture;

(iv) the Secretary of Commerce;

(v) the Secretary of Labor;

(vi) the Secretary of Health and Human Services;

(vii) the Secretary of Transportation;

(viii) the Secretary of Energy;

(ix) the Secretary of Education;

(x) the Administrator of the Environmental Protection Agency;

(xi) the Director of the Office of Management and Budget;

(xii) the Assistant to the President for Domestic Policy and Director of the Domestic Policy Council; and

(xiii) the Federal Co-Chair of the Appalachian Regional Commission.

(b) Mission and Work.

(i) The Interagency Working Group shall coordinate the identification and delivery of Federal resources to revitalize the economies of coal, oil and gas, and power plant communities; develop strategies to implement the policy set forth in section 217 of this order and for economic and social recovery; assess opportunities to ensure benefits and protections for coal and power plant workers; and submit reports to the National Climate Advisor and the Assistant to the President for Economic Policy on a regular basis on the progress of the revitalization effort.

(ii) As part of this effort, within 60 days of the date of this order, the Interagency Working Group shall submit a report to the President describing all mechanisms, consistent with applicable law, to prioritize grantmaking, Federal loan programs, technical assistance, financing, procurement, or other existing programs to support and revitalize the economies of coal and power plant communities, and providing recommendations for action consistent with the goals of the Interagency Working Group.

(c) Consultation. Consistent with the objectives set out in this order and in accordance with applicable law, the Interagency Working Group shall seek the views of State, local, and Tribal officials; unions; environmental justice organizations; community groups; and other persons it identifies who may have perspectives on the mission of the Interagency Working Group.

(d) Administration. The Interagency Working Group shall be housed within the Department of Energy. The Chairs shall convene regular meetings of the Interagency Working Group, determine its agenda, and direct its work. The Secretary of Energy, in consultation with the Chairs, shall designate an Executive Director of the Interagency Working Group, who shall coordinate the work of the Interagency Working Group and head any staff assigned to the Interagency Working Group.

(e) Officers. To facilitate the work of the Interagency Working Group, the head of each agency listed in subsection (a) of this section shall assign a designated official within the agency the authority to represent the agency on the Interagency Working Group and perform such other duties relating to the implementation of this order within the agency as the head of the agency deems appropriate.

SECURING ENVIRONMENTAL JUSTICE AND SPURRING ECONOMIC OPPORTUNITY

Sec. 219. *Policy.* To secure an equitable economic future, the United States must ensure that environmental and economic justice are key considerations in how we govern. That means investing and building a clean energy economy that creates well-paying union jobs, turning disadvantaged communities—historically marginalized and overburdened—into healthy, thriving communities, and undertaking robust actions to mitigate climate change while preparing for the impacts of climate change across rural, urban, and Tribal areas. Agencies shall make achieving environmental justice part of their missions by developing programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts. It is therefore the policy of my Administration to secure environmental justice and spur economic opportunity for disadvantaged communities that have been historically marginalized and overburdened by pollution and underinvestment in housing, transportation, water and wastewater infrastructure, and health care.

Sec. 220. *White House Environmental Justice Interagency Council.* (a) Section 1–102 of Executive Order 12898 of February 11, 1994 (Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations), is hereby amended to read as follows:

"(a) There is hereby created within the Executive Office of the President a White House Environmental Justice Interagency Council (Interagency Council). The Chair of the Council on Environmental Quality shall serve as Chair of the Interagency Council.

"(b) Membership. The Interagency Council shall consist of the following additional members:

(i) the Secretary of Defense;

(ii) the Attorney General;

(iii) the Secretary of the Interior;

(iv) the Secretary of Agriculture;

(v) the Secretary of Commerce;

(vi) the Secretary of Labor;

(vii) the Secretary of Health and Human Services;

(viii) the Secretary of Housing and Urban Development;

(ix) the Secretary of Transportation;

(x) the Secretary of Energy;

(xi) the Chair of the Council of Economic Advisers;

(xii) the Administrator of the Environmental Protection Agency;

(xiii) the Director of the Office of Management and Budget;

(xiv) the Executive Director of the Federal Permitting Improvement Steering Council;

(xv) the Director of the Office of Science and Technology Policy;

(xvi) the National Climate Advisor;

(xvii) the Assistant to the President for Domestic Policy; and

(xviii) the Assistant to the President for Economic Policy.

"(c) At the direction of the Chair, the Interagency Council may establish subgroups consisting exclusively of Interagency Council members or their designees under this section, as appropriate.

"(d) Mission and Work. The Interagency Council shall develop a strategy to address current and historic environmental injustice by consulting with the White House Environmental Justice Advisory Council and with local environmental justice leaders. The Interagency Council shall also develop clear performance metrics to ensure accountability, and publish an annual public performance scorecard on its implementation.

"(e) Administration. The Office of Administration within the Executive Office of the President shall provide funding and administrative support for the Interagency Council, to the extent permitted by law and within existing appropriations. To the extent permitted by law, including the Economy Act (31 U.S.C. 1535), and subject to the availability of appropriations, the Department of Labor, the Department of Transportation, and the Environmental Protection Agency shall provide administrative support as necessary.

"(f) Meetings and Staff. The Chair shall convene regular meetings of the Council, determine its agenda, and direct its work. The Chair shall designate an Executive Director of the Council, who shall coordinate the work of the Interagency Council and head any staff assigned to the Council.

"(g) Officers. To facilitate the work of the Interagency Council, the head of each agency listed in subsection (b) shall assign a designated official within the agency to be an Environmental Justice Officer, with the authority to represent the agency on the Interagency Council and perform such other duties relating to the implementation of this order within the agency as the head of the agency deems appropriate."

(b) The Interagency Council shall, within 120 days of the date of this order, submit to the President, through the National Climate Advisor, a set of recommendations for further updating Executive Order 12898.

Sec. 221. *White House Environmental Justice Advisory Council.* There is hereby established, within the Environmental Protection Agency, the White House Environmental Justice Advisory Council (Advisory Council), which shall advise the Interagency Council and the Chair of the Council on Environmental Quality.

(a) Membership. Members shall be appointed by the President, shall be drawn from across the political spectrum, and may include those with knowledge about or experience in environmental justice, climate change, disaster preparedness, racial inequity, or any other area determined by the President to be of value to the Advisory Council.

(b) Mission and Work. The Advisory Council shall be solely advisory. It shall provide recommendations to the White House Environmental Justice Interagency Council established in section 220 of this order on how to increase the Federal Government's efforts to address current and historic environmental injustice, including recommendations for updating Executive Order 12898.

(c) Administration. The Environmental Protection Agency shall provide funding and administrative support for the Advisory Council to the extent permitted by law and within existing appropriations. Members of the Advisory Council shall serve without either compensation or reimbursement of expenses.

(d) Federal Advisory Committee Act. Insofar as the Federal Advisory Committee Act, as amended (5 U.S.C. App.), may apply to the Advisory Council, any functions of the President under the Act, except for those in section 6 of the Act, shall be performed by the Administrator of the Environmental Protection Agency in accordance with the guidelines that have been issued by the Administrator of General Services.

Sec. 222. *Agency Responsibilities.* In furtherance of the policy set forth in section 219:

(a) The Chair of the Council on Environmental Quality shall, within 6 months of the date of this order, create a geospatial Climate and Economic Justice Screening Tool and shall annually publish interactive maps highlighting disadvantaged communities.

(b) The Administrator of the Environmental Protection Agency shall, within existing appropriations and consistent with applicable law:

(i) strengthen enforcement of environmental violations with disproportionate impact on underserved communities through the Office of Enforcement and Compliance Assurance; and

(ii) create a community notification program to monitor and provide real-time data to the public on current environmental pollution, including emissions, criteria pollutants, and toxins, in frontline and fenceline communities—places with the most significant exposure to such pollution.

(c) The Attorney General shall, within existing appropriations and consistent with applicable law:

(i) consider renaming the Environment and Natural Resources Division the Environmental Justice and Natural Resources Division;

(ii) direct that division to coordinate with the Administrator of the Environmental Protection Agency, through the Office of Enforcement and Compliance Assurance, as well as with other client agencies as appropriate, to develop a comprehensive environmental justice enforcement strategy, which shall seek to provide timely remedies for systemic environmental violations and contaminations, and injury to natural resources; and

(iii) ensure comprehensive attention to environmental justice throughout the Department of Justice, including by considering creating an Office of Environmental Justice within the Department to coordinate environmental justice activities among Department of Justice components and United States Attorneys' Offices nationwide.

(d) The Secretary of Health and Human Services shall, consistent with applicable law and within existing appropriations:

(i) establish an Office of Climate Change and Health Equity to address the impact of climate change on the health of the American people; and

(ii) establish an Interagency Working Group to Decrease Risk of Climate Change to Children, the Elderly, People with Disabilities, and the Vulnerable as well as a biennial Health Care System Readiness Advisory Council, both of which shall report their progress and findings regularly to the Task Force.

(e) The Director of the Office of Science and Technology Policy shall, in consultation with the National Climate Advisor, within existing appropriations, and within 100 days of the date of this order, publish a report identifying the climate strategies and technologies that will result in the most air and water quality improvements, which shall be made public to the maximum extent possible and published on the Office's website.

Sec. 223. *Justice40 Initiative.* (a) Within 120 days of the date of this order, the Chair of the Council on Environmental Quality, the Director of the

Office of Management and Budget, and the National Climate Advisor, in consultation with the Advisory Council, shall jointly publish recommendations on how certain Federal investments might be made toward a goal that 40 percent of the overall benefits flow to disadvantaged communities. The recommendations shall focus on investments in the areas of clean energy and energy efficiency; clean transit; affordable and sustainable housing; training and workforce development; the remediation and reduction of legacy pollution; and the development of critical clean water infrastructure. The recommendations shall reflect existing authorities the agencies may possess for achieving the 40-percent goal as well as recommendations on any legislation needed to achieve the 40-percent goal.

(b) In developing the recommendations, the Chair of the Council on Environmental Quality, the Director of the Office of Management and Budget, and the National Climate Advisor shall consult with affected disadvantaged communities.

(c) Within 60 days of the recommendations described in subsection (a) of this section, agency heads shall identify applicable program investment funds based on the recommendations and consider interim investment guidance to relevant program staff, as appropriate and consistent with applicable law.

(d) By February 2022, the Director of the Office of Management and Budget, in coordination with the Chair of the Council on Environmental Quality, the Administrator of the United States Digital Service, and other relevant agency heads, shall, to the extent consistent with applicable law, publish on a public website an annual Environmental Justice Scorecard detailing agency environmental justice performance measures.

PART III—GENERAL PROVISIONS

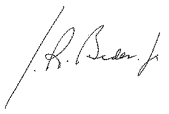
Sec. 301. *General Provisions.* (a) Nothing in this order shall be construed to impair or otherwise affect:

(i) the authority granted by law to an executive department or agency or the head thereof; or

(ii) the functions of the Director of the Office of Management and Budget, relating to budgetary, administrative, or legislative proposals.

(b) This order shall be implemented consistent with applicable law and subject to the availability of appropriations.

(c) This order is not intended to, and does not, create any right or benefit, substantive or procedural, enforceable at law or in equity by any party against the United States, its departments, agencies, or entities, its officers, employees, or agents, or any other person.



THE WHITE HOUSE,
January 27, 2021.

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