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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.