U.S. DEPARTMENT OF ENERGY

Climate Adaptation and Resilience Plan: 2022 Progress Report

Report to the White House

Federal Chief Sustainability Officer

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Cover photo credits (left to right): TOP ROW - Thunderstorm near Cuero, TX [Lance Cheung, United States Department of Agriculture (USDA)]. MIDDLE ROW - Western Area Power Administration's tower after a storm [WAPA], Camillo Fire in Coconino National Forest [Liza Simmons, USDA Forest Service], inundated oil distribution equipment [DOE/Strategic Petroleum Reserve]. BOTTOM ROW - Selective undergrounding of overhead power lines [Consolidated Edison Inc.], National Renewable Energy Laboratory's 1.5MW wind turbine behind a 450kW photovoltaic array [NREL], elevated substation [Entergy Corporation].

U.S. Department of Energy

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Climate Adaptation and Resilience Plan

2022 Progress Report

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Agency Climate Adaptation Webpage	https://www.energy.gov/management/spd/sustainability-performance-division

SECTION 1: UPDATES ON PRIORITY ACTIONS

Action	Current Status	Estimated Date of Completion	Brief Description of Progress
PRIORITY ACTION 1: Assess Vulnerabilities and Implement Resilience Solutions at DOE Sites	In Progress	Ongoing	DOE's sites are working to complete Vulnerability Assessments and Resilience Plans (VARPs) by September 30, 2022. Resilience solutions will be implemented, and progress will be tracked and assessed annually.
PRIORITY ACTION 2: Enhance Climate Adaptation and Mitigation Co-benefits at DOE Sites	In Progress	Ongoing	DOE is deploying adaptation and mitigation strategies that reduce energy and water use, reduce greenhouse gas (GHG) emissions, enhance electrification and the use of carbon pollution-free electricity (CFE), and improve carbon storage.
PRIORITY ACTION 3: Institutionalize Climate Adaptation and Resilience Across DOE Policies, Directives, and Processes	In Progress	Ongoing	DOE is institutionalizing climate adaptation and resilience by updating policies and plans, guidance, building codes, and standards to include sustainability and climate considerations.
PRIORITY ACTION 4: Provide Climate Adaptation Tools, Technical Support, and Climate Science Information	In Progress	Ongoing	Climate tools, technical support, and information have been developed and made available across the Department to improve climate literacy, identify climate change vulnerabilities, and to assist in the development and deployment of resilience solutions.
PRIORITY ACTION 5: Advance Deployment of Emerging Climate Resilient Technologies	In Progress	Ongoing	DOE is developing and deploying climate resilient technologies across its sites and is partnering with federal agencies and external stakeholders to accelerate the adoption of innovative climate change technologies within energy and environmental justice communities.

PRIORITY ACTION 1: Assess Vulnerabilities and Implement Resilience Solutions at DOE Sites

- The Department of Energy (DOE) issued guidance for sites to develop Vulnerability Assessments and Resilience Plans (VARP), including a new Risk Assessment Tool for sites to use during the VARP process. This tool helps sites identify current hazards and assess future impacts of climate change. DOE is collaborating with the National Oceanic and Atmospheric Administration (NOAA) to provide online training, with hundreds of DOE Headquarters and field personnel already trained since December 2021, to understand regional climate data and projections, and increase awareness of climate tools and resources (e.g., Climate Explorer, Climate Resilience Toolkit, National Climate

Assessment). Along with ongoing technical assistance, these resources and trainings are being used to develop site VARPs and inform site level resilience solutions and planning. Completed site VARPs, including proposed resilience solutions, are due by September 30, 2022.

- The Department is using the National Climate Assessment (NCA) as a climate science information resource for conducting DOE site-specific climate vulnerability assessments and developing resilience plans. DOE and the National Laboratories are serving in a lead role in support of the U.S. Global Change Research Program's development of the congressionally mandated Fifth National Climate Assessment that will provide up-to-date climate science information for DOE to assess potential site operational impacts of climate change now and into the future.
- DOE's National Nuclear Security Administration (NNSA) is establishing an Energy Resilient Infrastructure and Climate Adaptation (ERICA) initiative to improve mission delivery resilience. The initiative will be a critical element of NNSA's multi-faceted strategy to identify, prioritize, and implement infrastructure investments that increase energy resilience, energy security, and sustainability in support of the agency's national security missions. Pending appropriations, ERICA will start in fiscal year (FY) 2023 and include various types of projects including renewable energy generation, battery storage, and other power and water system upgrades.
- DOE sites utilize Federal hydropower as one of many sources of electricity and are currently conducting the third Congressionally mandated nationwide assessment on the observed and projected impacts of climate change on water supplies for hydroelectric power. This assessment will address vulnerability and risk from drought, decreased snowpack, elevated river temperatures, and flooding, and will potentially influence resilience planning for DOE site operations and other users.
- DOE is reviewing the reliability of key technology supply chains, such as large-capacity-batteries, that could be used for storage and backup power to increase resilience of DOE sites. In June 2021, DOE published a 100-day review of the large-capacity-battery supply chain which assessed and recommended establishing a resilient, secure, and economical domestic production and processing capabilities for large-capacity-batteries. Revitalizing domestic manufacturing capacity, and research and development applications can create a resilient, secure, and sustainable supply chain.
- In February 2022, DOE launched the Sustainable Climate-Ready Sites (SCRS) program Pilot. SCRS recognizes and rewards DOE site achievements in several categories, including natural and cultural resource stewardship, sustainability, climate resilience, and environmental justice. SCRS responds to DOE's commitments in the DOE Climate Adaptation and Resilience Plan to weave land use planning and ecosystem health into DOE's approach to climate change resilience and mitigation. SCRS will enable DOE to highlight innovations in climate resilience planning and assess how these activities are integrated with the broader environmental and sustainability efforts at each site. The Department plans to use lessons learned from the program pilot and launch the program in October 2022.

PRIORITY ACTION 2: Enhance Climate Adaptation and Mitigation Co-benefits at DOE Sites

- DOE is in the process of electrifying its transportation fleet; an action that will increase DOE site resilience by leveraging the battery storage and bi-directional charging capabilities of electric vehicles to provide backup power during outages. In FY2022, DOE ordered more than 270 electric vehicles to replace older gas fueled light and medium duty vehicles. This was double the number of zero-emission vehicles that existed in DOE's motor vehicle fleet. In accordance with the DOE FY 2022 Zero-emission Vehicle Fleet Strategic Plan, DOE is also installing a network of electric charging stations

across DOE sites. One DOE site is on track to be the first Federal site to achieve a 100 percent zero-emission motor vehicle fleet within the next two years. Another DOE site is working to convert all its industrial and underground vehicles to electric-only.

- On July 26, 2022, Secretary Granholm issued the Department's Carbon Pollution-Free Electricity Roadmap which will increase resilience at DOE sites as well as address the Administration's dual goals of 100 percent net-annual CFE by 2030 and 50 percent 24/7 CFE. Roadmap implementation will result in establishing ambitious annual performance targets and objectives, developing aggressive program-specific implementation plans, and identifying short and long-term actions to demonstrate continuous progress. Strategies include enhanced deployment of energy efficiency, energy demand flexibility, and battery storage; deployment of onsite CFE generation; and increased procurement of CFE. These strategies will contribute to enhanced resilience through reductions in electricity demand and increases in onsite distributed energy sources with microgrids and battery storage that can be used during power outages.
- DOE is assessing the potential to implement increasing onsite carbon-free energy projects through the deployment of a variety of energy technologies, including those that could be deployed at remote locations, and partnering with the private sector. For example, DOE is developing a report to Congress to assess how small modular reactors (SMRs) and microreactors can enhance the Department's energy resilience and reduce its carbon emissions. In addition, one DOE site is in discussions with its utility provider to determine the feasibility of installing a 10MW solar field to mitigate greenhouse gas (GHG) emissions, reduce operating costs, and increase resilience.
- DOE is initiating a Better Buildings and Better Plants pilot to demonstrate specific innovative policies and approaches that will enhance resilience by increasing energy savings for buildings, and accelerate improvements in energy efficiency, as well as reductions in energy intensity to achieve low carbon emissions. As part of the Low Carbon Pilot, DOE is collaborating with industry and interested parties over the next two years to demonstrate real-world pathways to reduce energy demand and GHG emissions from building and manufacturing operations and share these solutions with the market as well as potential deployment at DOE sites. Partners are working with DOE to demonstrate what is possible, remaining challenges, and successful solutions. Approaches will focus on buildings and plants characterized by high-performance building envelopes and energy efficient heating, ventilation, air-conditioning systems, as well as lighting, appliances, and technologies using onsite renewable energy sources that can contribute to both enhanced climate resilience and mitigation.
- To reduce energy demand and increase resilience, DOE funded replacement of a natural gas fired boiler at one of its sites with an electricity powered boiler. The new system will be approximately 99 percent more efficient, significantly reducing energy demand.
- The Department supported construction of the Energy Science Center laboratory/office/conference building with design enhancements resulting in greater resilience to climate change as well as reduced emissions. The 140,000 square foot building meets high-performance sustainable building standards and features an energy- and water-reducing design taking advantage of ample natural light and using waste-heat energy generated by high-performance computers housed in an adjacent building thereby enhancing resilience and mitigation co-benefits through reduced energy demand.
- DOE's Sustainable and Climate Ready Sites (SCRS) Program Pilot recognizes sites successfully prioritizing landscape and ecosystem health in their land use management and operations. By preserving and maintaining native vegetation, sites will sequester more carbon and improve resilience by maintaining soil quality and moisture retention, helping to limit damage from wildfires

and flooding. The 2022 SCRS Pilot obtained information from sites on current site practices; long-term, SCRS will identify opportunities for improvement, promote related resilience measures, and recognize DOE site progress and leadership in resilience-enhancing land use planning.

PRIORITY ACTION 3: Institutionalize Climate Adaptation and Resilience Across DOE Policies, Directives, and Processes

- DOE is updating DOE Order 436.1, *Departmental Sustainability,* with completion targeted for FY2023. The updated Order will institutionalize sustainability, environmental stewardship, and climate resilience planning at DOE, as well as integrate new sustainability requirements.
- In March 2022, the Department published final rules updating building energy code requirements for all new buildings and major retrofits constructed by the Federal Government effective April 2023. The updated requirements include compliance with the 2021 International Energy Conservation Code (IECC) and the 2019 American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) Standard 90.1 building energy codes. DOE estimates that these measures will save the Federal Government $4.2 million in operating costs within the first year of implementation.
- In April 2022, DOE issued a policy memorandum that sets requirements for Departmental elements to, among other things: meet the latest ASHRAE Energy Standard in new building design, design new buildings as net-zero emissions buildings, and consider local climate risks in building design. DOE plans to incorporate these requirements into the next revision of DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*.
- Within NNSA, the October 25, 2021, *Department of Energy Climate Adaptation and Resilience Plan and Vulnerability Assessment and Resilience Planning Implementation* memo advances the integration of climate adaptation and mitigation into NNSA policies, programs, operations, decision making, and established the NNSA Climate Adaptation and Resilience Working Group.

PRIORITY ACTION 4: Provide Climate Adaptation Tools, Technical Support, and Climate Science Information

- DOE worked with a cohort of six sites to provide support for its Technical Resilience Navigator (TRN), which helps sites identify critical energy and water systems and prioritize solutions that reduce risks. Virtual workshop sessions were held from September 2021 through May 2022 to provide instruction on the use of the TRN tool, enhance understanding of vulnerabilities in their energy and water systems, develop solutions to reduce risk, and integrate this knowledge throughout planning and continuity processes.
- DOE is engaging in meaningful, ongoing listening sessions with communities who raise environmental justice concerns and identifying technical assistance, tools and training needs deemed most critical by the energy and environmental justice community to address climate change, including climate adaptation and resilience. DOE is also working to incorporate environmental justice considerations into DOE requests for information and funding opportunity announcements as part of the Bipartisan Infrastructure Law implementation.

- In FY 2022, the Department launched the Center for Climate Resilience and Decision Science. This Center will serve as a focal point for DOE, other Federal agencies, industry, and communities in accessing the data, information, and tools necessary to pursue effective climate resilience planning. This will include a climate data portal, currently under development, that will provide communities, industry, and other stakeholders with broad access to local-scale projections of future climate impacts, which can be used to inform vulnerability assessments and the development of resilience plans. The Center's strong emphasis on incorporating community end-user feedback into the design of future models and climate impact datasets will ensure the strongest connection between laboratory science and its real-world use and application.
- DOE National Laboratories created many tools to advance climate resilience planning. For example, DOE's E3SM links Earth system and energy models into simulation projects to investigate energy-relevant science using code optimized for DOE's advanced computers.
- DOE is collaborating with NOAA to provide online climate resilience training, including train-the-trainer sessions, for DOE headquarters and field personnel to enhance awareness and access to regional climate information and resilience planning tools.
- DOE is participating on the Climate Smart Infrastructure (CSI) Interagency Working Group (IWG) Subcommittee on Climate Science, Data, and Information, led by the Office of Science and Technology Policy (OSTP) and NOAA. The Subcommittee was established to provide more advanced, accessible climate-related risk information and data by informing/shaping a READI (Resilience and Adaptation Information) geographic information system (GIS) based Portal that can support infrastructure climate reviews for agencies and grantees.

PRIORITY ACTION 5: Advance Deployment of Emerging Climate Resilient Technologies

- In May 2022, Secretary Granholm announced $38 million to begin a Net Zero Labs (NZL) initiative at 4 of DOE's 17 National Laboratories in support of President Biden's climate goals. The NZL Pilot Initiative will include climate resilience solutions such as: establishing an integrated secure microgrid system with SMRs and renewables, battery storage and hydrogen production; renewable backup power systems, and procurement opportunity of solar and energy storage through a power purchase agreement; and updating building design standards to align with net zero goals as well as reduce energy demand and maintain thermally comfortable buildings during extreme temperature events. The NZL Pilot will lay the foundation for solutions that can be replicated at facilities across DOE, the Federal Government, and state and local governments. Additional funding, available on a competitive basis to all 17 National Laboratories, is expected to be available next year.
- DOE is supporting several nuclear demonstration test bed projects that could potentially increase the use of reliable and resilient carbon pollution-free electricity at DOE sites. In March 2022, DOE completed the conceptual design of two National Reactor Innovation Center test beds to enable the testing and development of advanced reactor concepts. By September 2023, DOE will complete construction of the Microreactor Applications Research Validation and Evaluation (MARVEL) test bed to enable operation in FY 2024 to support the development and future demonstration of microreactor designs that can contribute to both reduced GHG emissions and increased resilience.
- DOE is creating an entrepreneurial pipeline to accelerate the development of emerging climate change resilient technologies within energy and environmental justice communities by providing educational opportunities such as internships. As of April 2022, over 800 students from Minority

Serving Institutions (MSI) have started applications to participate in DOE's 2022 Minority Educational Institutions Student Partnership Program as of April 2022. Over 1200 Minority/Small Businesses, MSIs, students, and others have attended DOE's Minority Programs outreach events since January 2022.

- To increase site resilience and reduce greenhouse gas emissions, DOE is partnering with the Council on Environmental Quality (CEQ), General Services Administration (GSA), Department of Defense (DoD), Department of State (DOS), and a National Laboratory to pilot an aggregated Federal procurement initiative for increased carbon pollution-free electricity to demonstrate new and novel approaches to U.S. Government (USG) CFE procurement. The pilot could include deployment of an onsite solar array that could provide CFE as well as power during outages. The pilot will help illustrate how the USG can overcome existing technological, organizational, and market barriers to USG CFE procurement while meeting both CFE and resilience goals.

SECTION 2: UPDATES ON OTHER INITIAL PLAN TOPICS

1. Climate Risk-Reduction:

As part of its VARP guidance, DOE developed a Risk Assessment Tool for sites to assess the impacts of climate hazards on critical assets and infrastructure. Critical assets and infrastructure assessed include workforce, energy generation and distribution systems, water systems, transportation and fleet infrastructure, site buildings, supply chains, mission specific equipment, and other supplies needed to conduct a site's mission. The Risk Assessment Tool guides users to identify and score asset criticality, hazard likelihood, hazard impact, and asset vulnerability. The tool then outputs a risk matrix, which showcases an asset's risk for each identified climate hazard. Using this tool, DOE sites can assess and develop resilience solutions for each of their critical assets. DOE is evaluating approaches to incorporate fiscal related risk exposure on DOE assets into the next iteration of site VARP guidance and Risk Assessment Tool.

Since the issuance of the DOE's Climate Adaptation and Resilience Plan, DOE sites have been developing VARPs by researching and interpreting the climate projections in their regions, identifying critical assets and infrastructure, and determining the risk present on these assets. Sites are currently developing resilience solutions to address risks. These solutions will be tracked yearly to ensure that resilience and adaptation measures are being implemented. Additionally, site VARPs are to be updated at least every four years. This process will ensure that continual progress is made to increase resilience and reduce climate related financial and operational risks.

2. Climate Vulnerability Assessments:

DOE sites are currently working on individual VARPs, which are due on September 30, 2022. The VARPs will allow DOE to assess its climate vulnerabilities at each location, factoring in each sites' relative climate hazards, critical assets, and distinct missions. Sites will incorporate the findings into their site-wide policy and planning documents. Upon completion of the VARPs, DOE will compile a synthesis document and track the implementation of resilience measures at each site. The Department has established a tracking system for progress on project implementation of the Climate Adaptation and Resilience Plan and site VARPs.

3. Climate Literacy:

DOE is developing a climate training program and a climate resource hub for DOE employees. DOE will leverage existing climate training from other agencies to create a "Climate 101" course for DOE employees, as well as additional tailored annual climate training for job classifications that require them.

As a part of the Department's celebration of Earth Day, DOE sponsored a range of activities to bring greater awareness and support for responsible climate and sustainability action. These activities included: a release of a video by DOE's Chief Sustainability Officer detailing the actions the Department is taking to combat the climate crisis; the release of materials to promote climate action by the DOE workforce; an infographic and blog post to explain DOE's Climate Adaptation and Resilience Plan; a bingo game with resources for families to take climate action at home; and a guidebook to help people live more sustainably. This guidebook includes resources and activities to lower individual's carbon footprints and encourages employees to incorporate sustainable climate friendly habits at home, in their commute, while making purchases, and in other everyday activities.

4. Tribal Engagement

In July 2021, DOE provided $12 million to 13 Native American and Alaska Native communities for projects that will reduce energy costs and increase energy security and resilience, which included additional cost share reductions for the first time. The selected projects will power homes and communities, make buildings more energy efficient, and install microgrids for essential services and resiliency. The Department is also exploring opportunities to collaborate with Tribes to deploy carbon pollution-free electricity on DOE lands and/or adjacent Tribal lands.

5. Environmental Justice:

DOE is working on several initiatives to foster energy and environmental justice. DOE has led collaborative workshops with the National Laboratories to introduce minority businesses and minority serving institutions to programs and opportunities across the complex. DOE partners with and provides technical assistance to 18 program offices across the Department on their stakeholder engagement efforts pursuant to the Justice40 Initiative. To demonstrate the efficacy of DOE energy and environmental justice efforts, DOE and program offices evaluated possible benefit metrics for 63 Justice40 covered programs. Benefit metrics categories include clean energy access, resilience, reducing environmental burden, clean energy enterprise creation, and reducing energy burden, among others. DOE is refining the benefits calculation methodology and developing a strategy for communicating metrics to stakeholders.

DOE launched the Communities LEAP (Local Energy Action Program) Pilot to help low-income, energy-burdened communities and communities with ties to fossil fuel industries access the economic and environmental benefits of clean energy and clean energy manufacturing. The program will provide services up to a total of $16 million to help develop community-driven plans to more effectively leverage public and private sector resources to reduce local air pollution, increase energy resilience, lower utility costs and energy burdens, and create well-paying jobs.

6. Partnerships:

DOE has collaborated with several other Federal agencies, the CEQ, and U.S. Global Change Research Program (USGCRP) to share climate planning tools, training materials, lessons learned, and best practices, as well as to develop resilience planning methodologies. Examples include:

1. Partnering with NOAA to host training on climate science tools.
2. Collaborating with the Office of Personnel Management's climate training and literacy study to leverage climate training materials.
3. Engaging with USGCRP Federal Adaptation and Resilience Group to develop methods for quantifying the benefits of climate resilience investments and identify opportunities for improvement.
4. Participating on the Climate Smart Infrastructure (CSI) Interagency Working Group (IWG) Subcommittee on Climate Science, Data, and Information, to provide more advanced, accessible climate-related risk information and data by informing/shaping a READI (Resilience and Adaptation Information) GIS-based Portal.

SECTION 3: NEW TOPICS FROM E.O. 14057

1. Policy Review:

The DOE Directives Program is the Department's primary means to institutionalize policies for all Department of Energy organizations. The Department is reviewing and modifying its applicable directives to institutionalize climate action.

DOE does not anticipate barriers to updating its policy directives. The Department's process for incorporating climate action requirements into all appropriate directives and orders is a formal one and requires extensive coordination and concurrence across the Department to ensure implementation of fully considered effective and durable changes.

2. Climate Scenario Analysis:

Multiple climate projection tools are being used at the site level to identify climate-related risks. DOE's VARP guidance recommends that sites use publicly accessible projection tools such as the USGCRP National Climate Assessment, NOAA's State Climate Summaries and Climate Resilience Toolkit, and National Environmental Modeling and Analysis Center's (NEMAC) Climate Explorer to identify climate hazards.

DOE also partnered with NOAA and NEMAC to provide DOE sites with climate science assistance sessions. These sessions provided demonstrations of available climate projection tools and sites learned how to access and interpret climate and extreme weather data. Sites then used this data to forecast the likelihood of site hazards and determine the effect of hazards on critical assets and infrastructure using the VARP Risk Assessment Tool. The Risk Assessment tool and associated risk matrix will inform site level resilience solution planning.

While the National Climate Assessment, State Climate Summaries, Climate Resilience Toolkit, and Climate Explorer are the primary tools used to inform site climate data and projections, many other tools have been provided to sites. These include several Federal tools such as Federal Emergency Management Program's National Risk Index tool, NOAA's Storm Event

Database, NOAA's National Integrated Drought Information System, and the National Fish and Wildlife's Coastal Resilience Evaluation and Siting Tool, among others. In addition, nonprofit resources such as the Climate Impact Lab are being used to inform site VARPs.

Program offices across DOE have been involved with incorporating climate information in decision making. All DOE sites are required to develop VARPs and will use these plans to set the basis for climate resilience and adaptation actions. In addition, the update to DOE Order 436.1, *Departmental Sustainability*, will institutionalize climate change planning and ensure that climate change is factored into decision making at the Department.