

STATEMENT OF  
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U.S. DEPARTMENT OF ENERGY  
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“HEARING ON THE RELIABILITY, RESILIENCY, AND AFFORDABILITY OF  
ELECTRIC SERVICE”

Thank you, Chairman Manchin, Ranking Member Barrasso, and Members of the Committee. My name is Mark A. Gabriel, and I am the Administrator of the Western Area Power Administration (WAPA). I am pleased to speak to you today regarding WAPA’s role in supporting the reliability, resilience, and affordability of electric service.

WAPA is one of four Power Marketing Administrations (PMAs) within the U.S. Department of Energy (DOE). Our responsibilities are to market and transmit wholesale electric hydropower from 14 multiuse water projects; to provide an integral transmission system for delivering that power; and to manage the Transmission Infrastructure Program (TIP), all to benefit the American public. WAPA markets and transmits hydropower from 57 Federal dams operated by the Bureau of Reclamation (Reclamation), the U.S. Army Corps of Engineers, and the International Boundary and Water Commission. This power benefits rural economies, Native American tribes, Federal and state agencies, and others who, in turn, serve more than 40 million Americans in the West. Our efforts to control costs, eliminate waste, and seek efficiencies help keep our rates among the lowest in the country and support economic prosperity and viability of the Western United States.

At the same time, we are reinvesting in our system to prepare for a new energy economy where renewable, intermittent generation resources dominate the marketable power supply and the transmission system becomes even more critical to transporting energy from where it is created to where it is used. In this testimony, I will share the value of hydropower, our response to recent national disasters, our commitment to maintain our historic levels of reliability and our plans to improve resilience through our existing programs, sensible investments, and increased advanced technology.

**WAPA’s Assets**

WAPA’s footprint encompasses about 1.3 million square miles of diverse ecosystems and populations, from urban to rural, plains to mountains, and deserts to forests. Spanning 15 states, the communities WAPA serves have a wide variety of energy interests and needs; we are cognizant that what works in Texas will likely not work in California, and the needs of customers in Arizona differ from the needs of customers in Colorado.

WAPA owns, operates, and maintains \$4.3 billion in power transmission assets on behalf of the Federal government and is one of the 10 largest transmission organizations in the Nation. We need to make well-informed, prudent, and realistic decisions about how to invest in our infrastructure to affordably support future needs. In the next 10 years, WAPA anticipates significant reinvestment in our assets. These would likely be the largest investments since the infrastructure was originally built in the middle of the 20th century.

WAPA continues to work with customers to flatten peaks in anticipated spending and provide measured and attainable financial expectations. The bulk of investment will maintain and upgrade the core transmission assets in our system, including more than 100,000 structures along 17,236 miles of high-voltage transmission lines, 324 substations, and 291 high-voltage transformers.

### **Value of Hydropower**

WAPA markets and delivers hydropower, providing unparalleled benefits to Americans in the Western United States. WAPA's rates are often among the lowest in the country, or the lowest rates for an entire state, such as in Arizona.

In an average year, WAPA markets and delivers more than 25,000 gigawatt-hours of hydroelectric power. This amount represents 100 percent of annual energy needs for about 2.3 million average American homes. All this power is sold at cost.

According to the DOE's Hydropower Vision Report, the U.S. hydropower fleet is comprised of approximately 2,200 power plants with a total capacity of roughly 102 gigawatts, including 95 percent of U.S. energy storage capacity (23 gigawatts) in the form of pumped storage. Hydropower employs around 66,500 workers.

Hydropower is a unique generation source, providing both grid stability and low-cost, low-carbon energy. According to the U.S. Energy Information Administration, it is one of the largest generators of clean, low-carbon electricity, representing seven percent of total U.S. electricity generation and 39.5 percent of renewable electricity generation in 2018. According to the DOE's Hydropower Vision Report, the Nation's hydroelectric fleet avoids about 225 million metric tons of carbon pollution in the U.S. each year, equivalent to the emissions of 42 million passenger cars.

In addition to its low-carbon benefits, hydropower provides the large rotating inertia required for a reliable electric grid and abundant capacity to meet energy demand at a moment's notice. Hydropower is also not reliant on daily weather. For those reasons, it is the ideal partner to wind, solar, and potentially non-hydro battery storage. We experience the benefits of this partnership as members of the Southwest Power Pool (SPP) Regional Transmission Organization, where hydropower from the Pick-Sloan Missouri Basin Program – Eastern Division provides the reliable energy backbone for the upper part of SPP's service territory, moderates costs to consumers, provides stability to wind and solar generation, and supports improved river and dam operations.

We are also working with our customers to identify opportunities to interconnect transmission-scale battery storage to WAPA's system. Customers and WAPA alike can take advantage of the benefits battery storage offers, including balancing load, increasing resource diversity, and managing changes in water availability.

One of the key challenges for today's electric utilities, and arguably the top challenge, is the decrease of inertial capacity required for a healthy system and lack of financial compensation for the remaining capacity. Each year, we are losing more of the stability that makes a resilient system possible while leaning more on low-carbon, reliable hydropower as a baseload resource and one of the few capable of restarting a system after a massive outage (also known as black start).

Black start is the provision of startup energy to restore power to generation facilities after a massive power system disturbance, similar to the Northeast outage in August 2003 or the Southwest outage in 2011. It is an oft-overlooked requirement that powerplants need energy to operate; without electricity, they suffer the same outages as residences and businesses. To provide this startup energy to a powerplant, utilities have placed emergency on-site generators at select plants and designated them black-start units. Hydropower frequently provides these capabilities in the Western United States.

Hydropower currently also supports national security. In addition to providing black-start capabilities, hydropower directly supplies many of the Nation's military bases and DOE's National Laboratories. WAPA supplies power to more than two dozen military bases and other highly sensitive facilities across the West. Many WAPA customers are similarly distributors of power to the bases and national security facilities. As part of the Defense Critical Electric Infrastructure Program, we have been working with the Department of Defense to secure direct feed power to the most critical bases in the West.

Despite the many benefits of hydropower, only three percent of dams in the U.S. can produce electricity, representing the potential for additional hydropower to be added to the grid by adding generation equipment to non-powered dams.

We collaborate closely with the generating agencies, power customers, and other stakeholders to assure the enduring value of the hydropower product in the face of drought, new regulations, and other constraints. The Federal dam system in the United States provides several valuable services to the American people that must be balanced for maximum benefit.

### **Responding to Natural Disasters**

Our fundamental responsibility is to keep the lights on for more than 40 million Americans. In no situation is this more evident than in responding to natural disasters and severe weather within and outside of WAPA's territory.

Recently, Winter Storm Uri brought historic freezing temperatures to our Upper Great Plains (UGP) region, which covers all or parts of North Dakota, South Dakota, Montana, Nebraska,

Iowa, and Minnesota. The majority of our UGP territory is a member of the Southwest Power Pool Regional Transmission Organization (SPP), a market operator and reliability coordinator in 17 central states that manages the reliability and buying and selling of energy and transmission for participating utilities. Due to the severity of the storm, SPP, implemented emergency energy alerts and rolling blackouts to preserve and protect the power grid, from irreparable damage and extended outages for the first time in its 80-year history.

On February 16, SPP directed WAPA to begin shedding load, the industry term for proactively cutting power to customers to protect the grid and consumers from widespread, uncontrolled, and dangerous long-term power outages. These rolling outages affected 21 WAPA customers in UGP for an average of 55 minutes and as long as 122 minutes. SPP was unable to meet demand because extremely low temperatures forced a number of generating resources offline, especially natural gas.

WAPA and SPP learned many lessons from this event, especially regarding advanced and frequent communication with our customers. The SPP and WAPA systems worked as designed during the energy emergency, sparing many communities from life-threatening situations and preventing damage to electrical infrastructure that could have taken months to repair.

The situation highlighted inherent weaknesses in our current energy environment, including that cold impacts every form of generation. We also learned what is missing from our situational awareness of the grid, specifically what loses power, when we are required to disconnect electricity to small, defined areas for discrete periods of time. There is no grid visibility or granularity to that level of detail. We generally know where the outage will occur in terms of surface area, but not what connections will be affected, residential, industrial, commercial, water plants or the Bakken Oil Field.

WAPA was not directly affected by the events in Texas. Through SPP, we provided surplus hydropower through the ties connecting to the Electric Reliability Council of Texas grid once SPP's energy emergency had concluded.

In August 2020, WAPA responded to support the California energy crisis. Between August 14 and 19, WAPA and Reclamation supplied California with 5,400 megawatt-hours (MWh) of hydropower during the state's first energy emergency in nearly 20 years.

Reclamation generated the power using its fleet of Federal hydroelectric dams in the West, including, among others, 18 dams in the Central Valley Project in northern California; Glen Canyon Dam in Page, Arizona; Hoover Dam on the border of Arizona and Nevada; Morrow Point Dam in western Colorado; Davis Dam in Arizona; and Parker Dam in California.

WAPA then transmitted the energy via its high-voltage transmission system into the California Independent System Operator's (CAISO) service territory, while continuing to reliably serve WAPA's customer loads. WAPA's Sierra Nevada region provided more than

3,300 MWh, while the Colorado River Storage Project provided nearly 1,900 MWh and Desert Southwest provided more than 200 MWh.

In some cases, WAPA was able to offset this generation and continue to meet its customers' demand by increasing hydropower output from other dams to provide power to local areas.

Hydroelectric dams are crucial sources of reserve energy in case of system emergencies. The large reservoirs, such as Lake Mead and Lake Powell, function as enormous batteries and can quickly dispatch a large amount of electricity on the grid. WAPA and Reclamation have plans in place with several utilities to provide emergency power from Federal hydroelectric powerplants.

As regular members of the Federal Emergency Management Agency's (FEMA) disaster response teams, WAPA employees have been activated to support power restoration in Hawaii after a volcanic eruption in 2018 and in Guam and the Northern Mariana Islands after they were struck by 2018's two strongest storms. We deployed personnel to advise power restoration following 2020's Hurricane Laura and sent line crews and other specialists to help rebuild the power grid following Superstorm Sandy, Hurricane Irma, and Hurricane Maria.

Employees, along with others carrying out Emergency Support Function-12 responsibilities within the National Response Framework, liaise between FEMA and the local utilities on power restoration plans; visit work crews to identify priorities and needed materials; and remove barriers to acquisition and transportation.

Severe natural disasters have recently struck WAPA facilities as well. In July 2018, the Carr Fire in northern California directly affected WAPA's system and that of its customers. At the fire's height, the Sierra Nevada region had 15 high-voltage transmission lines out of service, fires at the gates of its substations, and about a dozen hydroelectric generators out of service. Despite the unprecedented emergency situation, WAPA continued supplying power to the area, and worked one-on-one with communities to keep as many homes and businesses as energized as possible.

Once the fire passed, our maintenance workers, some of whom had been evacuated and some of whom sustained fire damage to their own property, immediately went to work repairing damaged assets, including replacing a number of steel structures destroyed by the "firenado" in Redding, California. Once WAPA's facilities were fully energized, our staff lent support to our neighbors and Reclamation to rebuild their systems.

That experience galvanized WAPA to more stringently apply vegetation management best practices, collaborate with customers, and set new standards. WAPA and many other utilities have common practices within their vegetation management programs, including multiple ground and aerial inspections a year. Lines at WAPA are inspected twice a year, except in California, where WAPA inspects our 1,000 miles of line five times a year. Crews observe and report any obvious issues to dispatchers while also recording their findings on inspection tools that feed into WAPA's Reliability-Centered Maintenance program for further action as needed.

We also contract with independent third-party inspectors to identify, validate, and review vegetation management work.

We have established relationships with land and fire management agencies at the state and local levels, such as CALFIRE, to ensure seamless coordination and communication during wildfire events. We also have trained on and incorporated the National Incident Management System vernacular and processes used by most of the Nation's first responders.

Our integrated vegetation management (IVM) program, championed by the Desert Southwest region, is highly effective and economical. IVM uses a two-stage approach: 1) reclaiming easement areas by clearing out tall-growing vegetation, leaving only low, natural vegetation in place; and 2) applying herbicides the following year to keep vegetation growth low.

The result is reduced ecological impact and savings compared to a one-time complete removal process. Removing fast or tall-growing vegetation allows the fire to pass under the transmission line without impacting it. This is important because maintaining a reliable flow of electricity is critical for serving customers in towns and cities across the West, especially when there is a fire or other natural disaster.

Each region also customizes their vegetation management based on the unique ecosystems present in their territory, whether it is forest, mountains, desert, or prairie. Following the devastating 2018 wildfire season, California passed a new law, SB 901, that required utilities to proactively work to mitigate the risk of wildfires started by power lines. Although WAPA is not subject to California jurisdiction, in certain cases we have chosen to comply with state requirements.

Our September 2019 Wildfire Mitigation Plan identifies specific steps to minimize the probability that our facilities may start, or contribute to, a wildfire. The plan establishes and maintains consensus and communications about de-energizing lines in response to a wildfire threat. It also outlines our expanded on-the-ground detailed inspections, vegetation and fuels inspections, potential risk and equipment failure detection technologies, and aerial inspection methods.

We are also participating on a local ad-hoc committee with other utilities to review wildfire mitigation efforts, remain compliant with California general orders and resource codes on vegetation management, and coordinate regularly with CALFIRE on fuel reduction projects, incident response teams, fire suppression efforts, and educational events. Since 2015, we have reinvested over \$78 million in the California system for preventive maintenance and upgrades.

In the Rocky Mountain region, which covers Colorado, Wyoming, and parts of Nebraska and Kansas, WAPA's Natural Resources team partnered with the U.S. Forest Service to gain access and conduct machine clearing in rights of way on two national forests that had only been hand-cut for over a decade, leaving potentially dangerous fuel buildup under the lines. WAPA was unable to properly maintain its lines on these two forests because of a lack of mechanized clearing.

Through this partnership, WAPA was given permission to clear vegetation that had grown under and around its transmission lines, an area threatened this year by the Wyoming-Colorado Mullen Fire. This effort garnered a Gears of Government award in 2020 from the Executive Office of the President, recognizing the team's exceptional work to deliver key outcomes for the American people, specifically around mission results, customer service, and accountable stewardship.

### **Maintaining a Reliable Grid**

WAPA's system experiences 99.999 percent uptime, contributing to the overall top reliability of the American grid. WAPA also operates a resilient system, weathering disruptions including storms, wildlife interactions, vehicle accidents, routine maintenance, and emergency situations with consumers unaware of most disruptions thanks to our system's redundancy and ability to section off problematic equipment.

To achieve this reliability and resilience, the organization focuses on security, quality, resilience, and availability; a best-in-class Reliability-Centered Maintenance program; a mature asset management program; aggressive integrated vegetation management; long-term capital planning; and support from our customers. We also participate in industry leadership and research groups, like the Electricity Subsector Coordinating Council and Institute of Electrical and Electronics Engineers, to seek and share leading industry practices with other utilities.

Utilities, including WAPA, continue to reinvest in their transmission systems. One of WAPA's core principles is to deliver services at the lowest possible cost in accordance with sound business practices. All WAPA investments are based on these core tenets, striving to enhance reliability and resilience of the high-voltage transmission system. This has resulted in an industry-leading system reliability rating, while keeping power, transmission, and other associated rates at levels that enable WAPA's customers to provide competitive energy prices. Through our 10-year capital planning process, we anticipate investing \$1.3 billion in our system over the next decade to ensure reliability. The 10-year capital planning process is a data-driven, well-defined methodology, fed by WAPA's asset management program, designed to maintain our transmission system to reliable standards.

WAPA's Asset Planning and Management program, established in 2014, uses objective data combined with field expertise to manage our assets based on risk and criticality. We use these data to communicate asset needs with customers and make informed business decisions so that the right investments occur in the right place at the right time and maximize the value of maintenance and capital efforts.

The Asset Planning and Management program continues to expand its database with new asset classes to better forecast and develop our annual budgets and 10-year capital plans. In the next few years, the program will incorporate health and condition factors for station batteries, two additional types of transformers, and network equipment. This year's new asset classes included load tap changers, transformer bushings, cranes, and power circuit breakers under 100 kilovolts.

The program is also seeking ways to more efficiently acquire large power transformers by reducing the procurement lead time from two years to between nine and 12 months. This will support lifecycle replacements, periodic system additions, and allow WAPA to more quickly recover from an unexpected loss of power transformers including a high-impact, low-frequency event.

One opportunity to increase the national power sector's reliability is to increase the capacity of our existing grid through rebuilds, modernizations, and capacity upgrades. Another is to build new transmission infrastructure to both transport the remote renewable energy resources to where the population resides and to better balance energy supply and demand. In the central U.S., new generation sources are not limited by lack of demand or siting issues, they are stymied by lack of transmission capacity. If there is not adequate transmission capacity to accept the new generation, regardless of its source, the plant cannot be built. Late last year, both SPP and Midcontinent Independent System Operator markets publicly announced and agreed to jointly study the problem of constrained transmission capacity.

Both new transmission projects and upgrades, large and small, continue to stall across the U.S. Several reasons have been cited for the recurring failure of transmission projects including limited financing; transmission siting, environmental reviews and permitting; and a poor return on equity making transmission an unprofitable venture for investors. In addition, changes in the marketplace may have raised the risk profile to unacceptable levels for traditional utilities, and some newer entrants may not yet have the long-term financial backing or experience to commit to the decades necessary for transmission contracts.

The American Recovery and Reinvestment Act of 2009 provided WAPA with \$3.25 billion in borrowing authority to fund transmission projects within its service territory that deliver, or facilitate the delivery of, power generated by renewable energy resources. WAPA staff also possesses the experience and connections to navigate the difficult path to build transmission. Since 2009, we have funded the construction of two transmission projects and supported the development of a third. There are at least eight other projects in the queue, which are delayed by lack of offtake partners and demand for the power.

### **Bolstering Resilience in the Energy Frontier**

Reliability is the confidence that the lights will turn on when we need them. It is a key pillar and tenet when operating a bulk electric system and is engrained in the culture at WAPA, as it is with any transmission provider operating and maintaining their respective portions of the electrical grid. For WAPA, system reliability is focused on safely and effectively delivering Federal hydroelectric power from 57 dams in the West. Much of utility-scale electric power reliability is dictated by sound business practices, regulatory directives, and industry standards that guide day-to-day operations across North America.

Resilience, conversely, is the ability to prevent, withstand, and recover from disruptive threats and events, such as natural or manmade disasters. When considering resilience during natural disasters, weather is not a root cause for an outage. If utilities eliminate weather as a root cause, they can ascertain the true weaknesses in an electric system, specifically which advancements

need to be made most urgently to improve resilience as well as reliable energy delivery. Rapidly advancing societal and technological changes are reshaping the energy landscape, and nefarious actors see electricity as a primary venue to disrupt the American economy and our way of life, necessitating a grid that is smarter, more connected, more secure, and more resilient.

Investing in more resilience, placing special emphasis on defense-critical electric infrastructure, would include hardening facilities, increasing redundant services, expanding and enhancing network communications systems, replacing wood with steel, and upgrading operations centers.

WAPA seeks to meet these challenges by developing a more resilient grid that responds to changing customer needs while defending against and combating physical and cyber threats. WAPA's resilience strategy focuses on enhancements to situational awareness, bulk electric system facilities and systems, black start and cranking paths, and the Eastern and Western Interconnection direct-current interties.

Upgrading the East-West interties that transfer power between the Eastern and Western Interconnections would cost effectively improve system flexibility and economic performance across the country. Access to power from the adjacent grids allows utilities to delay construction of powerplants needed to meet peak power demands.

These interties have the potential to transfer Arizona solar to energize East Coast evenings or share Iowa wind to support the energy needs of California mornings, but today are constrained by outdated technology and system limitations. Doubling the existing transfer capability between the two main grids in the U.S. would increase the bi-directional transfer capacity to 2,640 megawatts (MW)—about the equivalent of the seven large mainstem Federal hydroelectric dams along the Missouri River, six 600-MW natural gas plants or 66 20-MW battery storage systems. These upgrades could be completed faster and cheaper than building those new facilities or a transmission “superhighway.”

WAPA is also actively engaging in industry efforts to mitigate the effects of geomagnetic disturbances (GMD) and electromagnetic pulses (EMP). WAPA has been involved in preparing for and mitigating possible GMD and geomagnetically induced currents (GIC) disturbances since the beginning of the 21st century. By partnering with the Electric Power Research Institute's SUNBURST program, which collects diverse GMD-related data across the U.S., WAPA is contributing to a body of industry data that can help scientists model GICs, forecast when they will happen and develop ways to protect the grid. Specifically, the UGP region has equipped two substations with GIC-monitoring equipment conceived, designed and implemented by WAPA employees. The technology provides real-time situational awareness of GMD impacts on the transmission system to control center operators. As the technology has proven successful, WAPA intends to widen the network to its other regions as well as its neighbors and utility customers. WAPA is also supporting DOE efforts to study, prepare for, mitigate and describe EMP as required by the March 26, 2019 Executive Order on EMP. We continue to support scientific research and development, such as the Electric Power Research Institute's 2019 EMP report, share timely knowledge through industry forums, encourage readiness, and analyze policy needs for the future.

A comprehensive grid resilience approach includes awareness and hardening of physical assets. Grid surveillance is the process of obtaining situational awareness of the electrical grid through active data-gathering with appropriate analysis and interpretation of data. Sound decision-making leverages the knowledge gleaned through situational awareness. Using this approach, risks can be identified and prevented; responses can be more proactive than reactive.

Electric utilities potentially could integrate artificial intelligence (AI), machine learning (ML), and advanced technology solutions into grid operations to improve real-time situational awareness. Three potential equipment types for AI and ML technologies are transformers, transmission lines, and synchrophasors. These technologies could provide instant, real-time data leading to better ways to operate the grid while under stress.

Incorporating AI and ML could impact real-time contingency analysis, electricity dispatch, voltage and frequency management, energy and demand balancing, protective relaying, geomagnetically induced current monitoring, and system simulations. Advanced AI predictive modeling and forecasting could help electric utilities to track and respond to disruptive weather patterns before they occur, potentially improving contingency planning and limiting or preventing unnecessary damage or outages. With greater modeling and dynamic monitoring of weather and other factors, utilities will be able to better estimate the effects of weather on available capacity and energy, allowing us to recognize and respond faster to emerging contingencies.

Finally, AI and ML could be deployed to analyze data being captured in utilities' asset management programs to optimize equipment investment.

### **Closing Statement**

The industry is experiencing a wave of unprecedented changes and opportunities. The challenges before the energy industry are vast, but not insurmountable.

We remain steadfast to our mission, yet how we accomplish it is changing. Together, we can chart the course toward securing a reliable, resilient, and affordable energy future.

Thank you, Chairman Manchin. I would be pleased to answer any questions that you or the Committee members may have.