Written Testimony of
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INTRODUCTION

Chairman Manchin, Ranking Member Barrasso, and members of the Committee, thank you for the opportunity to appear today to represent one of the nation's largest utilities and a corporate agency of the federal government, the Tennessee Valley Authority (TVA).

I will mark my second anniversary as president and chief executive officer (CEO) of TVA next month. I am privileged and honored to lead the 10,000 women and men of TVA as we serve the nation and the communities and people of the Tennessee Valley region.

My career in the energy industry spans more than 40 years. I have worked both in public power and for investor-owned utilities. Before joining TVA, I was president & CEO of Ontario Power Generation, one of Canada's largest electric utilities with a diverse generating portfolio that included a large nuclear fleet.

Before that, I was president of CB&I Power, with responsibilities that included providing operating plant services for nuclear and other forms of generation. Formerly, I served in executive vice president capacities at Duke Energy and Progress Energy, and as the president and CEO of Progress Energy Florida. I spent a significant portion of my career building, maintaining and operating nuclear facilities.

I have held a Senior Reactor Operator's License issued by the U.S. Nuclear Regulatory Commission (NRC) and worked in a wide range of leadership roles at nuclear facilities including as operations manager, engineering manager, plant manager, and director of site operations.

Earlier in my career I served with the Nuclear Regulatory Commission in both technical and leadership positions.

I have a long career of active leadership in the electric power industry and in nuclear energy specifically. I believe that reliable and affordable electricity is foundational to our national security and our economy, that low carbon electricity will be critical to decarbonizing the broader economy, that a diverse portfolio of generating assets will best serve this objective, and that nuclear energy does now and must continue to play a vital role in our nation's energy supply. I appreciate the Committee's interest in this important resource.

TVA MISSION

TVA was established by Congress in 1933 and charged with carrying out a mission of service to the nation and to the people of the Tennessee Valley. Our unique, long-standing mission of service drives and inspires us daily to pursue new ideas and innovative solutions that improve our service to the communities and people we are privileged to serve.

TVA delivers on that mission through work in three key areas: energy that is low-cost and reliable; economic development that brings jobs and capital investment to the region; and environmental stewardship of the region's public lands, water and air. TVA was created with, and has continued to build on, its clear mission to benefit the public good.

This was our initial mission during the Great Depression. This was our mission while powering the nation to win World War II. This continued to be our mission during the subsequent decades of American growth and prosperity. And it is still our mission today.

The challenges are certainly different today than in 1933, but they are no less critical to the lives of those we are privileged to serve – delivering vital services and support across the region for almost 90 years, including during this unprecedented pandemic that continues to impact families, communities, businesses and industries. TVA's mission has stood the test of time.

THE PUBLIC POWER MODEL

TVA was established to serve the people of the Valley in partnership with local power companies, supplying public power at the lowest feasible rate for people throughout the region, from its largest cities to its most remote farms, and with an obligation to serve the people and their communities, not shareholders.

Together, TVA and local power companies ensure a reliable, clean and low-cost energy supply; a local presence and local voice; and the reinvestment of revenues into the energy, economic development, and environmental services that benefit the region. In this public power model, we now have new and stronger partnerships in place with 142 of the 153 local power companies we serve – 93% of them – and we are aligned around a 20-year commitment to plan and work together.

We also have strong relationships with our union partners. Over 60% of TVA's 10,000 employees are union members: over 6,000 annual employees and up to 3,000 hourly employees. A total of 17 unions represent TVA employees and contractors. In 2020, we entered into two historic agreements with our union partners – a 10-year extension of the recognition of the TVA Trades and Labor Council for Annual Employees as representing TVA craft employees, and a 10-year extension of TVA's project agreement with the North American Building Trades Union.

The TVA Retirement System administers retirement benefits for approximately 9,700 employees and 24,000 retirees and beneficiaries. Pension assets total $8 billion; liabilities are $13.6 billion; annual pension benefit payments total $720 million; with a plan to be fully funded for TVA's pension liability by 2036. TVA implemented a plan in 2016 focused on fully funding the pension over a 20 year period. The plan includes assumptions around system demographics, contributions, asset returns, and discount rates. The funding plan is ahead of schedule, and we have shared details of this plan with the Office of Management and Budget. Separately, 401(k) plan assets total $3.2 billion.

TVA'S OPERATION

TVA is the nation's largest public power supplier, providing energy that 10 million people across seven southeastern states rely on every day. We are also the nation's third-largest electricity generator and second-largest transmission system with 16,300 miles of high-voltage lines. TVA has one of the nation's largest, most diverse, and cleanest generating portfolios. Our portfolio includes hydroelectric, natural gas, coal, wind, and solar generation, as well as significant energy storage resources. In addition, and important to our discussion today, our portfolio includes the nation's third-largest nuclear fleet. In Fiscal Year 2020, our nuclear fleet generated 42% of the electricity delivered to our customers.

TVA-generated energy supports quality economic growth in the region with retail energy costs that ended calendar year 2020 lower than those at 79% of the nation's largest utilities, and industrial rates lower than those at 93% of other large utilities. The impact of a reliable, low-cost energy supply can be seen in the region's economic development successes. Over the past five years, TVA has helped attract or retain 341,000 jobs and more than $45.4 billion in capital investment for the region. In 2020, despite pandemic conditions, we helped the region gain 67,000 jobs and more than $8.6 billion in investment.

We manage the 652-mile Tennessee River system for multiple benefits, including flood control that prevented $1 billion in flood damage last year as the region experienced 150% of normal rainfall. The river system consists of more than 40,000 miles of rivers, streams and tributaries; and it enables commercial navigation, water supply and water quality, recreation and other benefits for the region. Nearly 50 million tons of commercial goods move through the system of locks and dams each year, saving half a billion dollars in annual shipping costs.

We use TVA's 49 dams to manage lake levels and river flows in order to balance the competing demands on the reservoir system, and our hydro-electric dams are TVA's original energy source. The river and reservoirs also support a thriving recreation industry that produces almost

$12 billion a year in economic activity, supporting more than 130,000 jobs and generating almost $917 million in tax revenues to the region's state and local governments.

TVA's responsibilities for environmental stewardship also make us an important contributor to ongoing efforts to improve air quality in the region and the nation. From 1970 to 2020, TVA invested $6.8 billion in environmental controls to reduce emissions from fossil-fueled plants. These investments have reduced our sulfur dioxide emissions 99% below 1977 levels. Nitrogen oxide emissions have been reduced 96% below 1995 levels. We have reduced greenhouse gas emissions by about 60% compared with the 2005 benchmark, one of the largest decreases in the power industry.

We do this with no federal appropriations of tax dollars. While TVA is a corporation of the federal government, TVA funds its power system and virtually all other operations entirely with revenues from energy sales and proceeds from debt issuances.

TVA was created in a time of great need for the nation – a time when new ideas and fresh approaches were essential to the economic recovery of the Tennessee Valley region. TVA and its broad mission represented a break with the past and a determination to bring new thinking to the problems at hand.

Those problems were vast. In 1933, personal income in the TVA region averaged $3,500 a year in today's dollars – and just 45% of the national average at that time. Nearly two-thirds of Valley residents were farmers, and only 3% of them had electricity. Even fewer had running water. Valley lands were ravaged by erosion, overuse and wildfires. In some parts of North Alabama, three people in five had malaria. The Tennessee River was unmanaged, subjecting the region to devastating floods year after year while at the same time impeding transportation in areas of shallow water and treacherous shoals.

TVA was tasked with addressing a wide range of challenges, and its strategy focused on the innovative concept of managing the vast resources of the Tennessee Valley as an integrated system, across jurisdictional boundaries, to benefit the region as a whole. TVA engineers built a

network of hydroelectric dams to achieve multiple purposes – providing not only low-cost power but also flood control, transportation, water quality, and more. TVA scientists and educators developed and promulgated groundbreaking fertilizer technology that helped revive the Valley's exhausted farmland and became the basis for 75% of the fertilizers used around the world. TVA engineers developed the nation's first 512-kV transmission systems to reliably link TVA to a regional family of local power companies across 80,000 square-miles. And TVA economic development specialists pursued collaborative approaches to recruiting and retaining investments that would create and sustain quality jobs.

TVA's commitment to developing and delivering new ideas transformed the Tennessee Valley region, leveraging the value of low-cost public power and going far beyond it, lifting the people of the Valley out of poverty and bringing the benefits of low-cost power to every community in the Valley.

In 2018, the region's per capita income had risen to 82% of the national level. The Valley's dependence on agriculture has shifted to an emphasis on industry, with only 0.5% of workers still employed in agriculture. TVA's early efforts to reforest the region with 570 million seedlings restored large tracts of land to beneficial use. TVA's integrated network of multi-purpose dams has averted more than $9.5 billion in potential flood damage since 1936.

Today, TVA is applying the same spirit of innovation and forward-thinking that revolutionized life in the Valley to the emerging challenges of our time through our focus on six signature technologies:

- Energy storage integration
- Grid transformation
- Connected communities
- Advanced nuclear solution
- Decarbonization options
- Electric vehicle evolution

FOCUSING ON BUILDING A DIVERSE PORTFOLIO

As I highlighted, one of TVA's core strengths is our clean generating portfolio – one of the largest and most diverse in the industry. We have diversified our generating assets, modernized the system, lowered fuel costs, and reduced emissions.

We are a national leader in carbon reduction, the largest clean-energy producing utility in the Southeast, including our hydro generation, and home to nationally recognized solar programs. We have nearly 50% more clean generation than our closest regional peer, again, including our hydro generation, and currently have one of the lowest greenhouse gas intensities per unit of electricity produced in the U.S., with about 60% of our generation free of greenhouse gas emissions.

But we aren't satisfied. We are committed to continuing to reduce greenhouse gas emissions while maintaining our focus on delivering low-cost, reliable energy that our customers expect and deserve for the long-term.

TVA has maintained a Climate Change Adaptation Plan that was last updated in July 2020, and we are currently developing our Climate Action Plan for completion in the coming months. The goal of the adaptation planning process is to ensure TVA continues to achieve its mission and program goals and operate in a secure, effective, and efficient manner in a changing climate by integrating climate change adaptation efforts in coordination with state and local partners, tribal governments, and private stakeholders.

TVA manages the potential effects of climate change on its mission, programs, and operations within its environmental management processes. TVA has reduced greenhouse gas emissions from both its generation stations and its operations. Recent TVA Board actions have focused on TVA's 2019 integrated resource plan to balance its coal-fired generation by increasing its nuclear capacity, modernizing its hydroelectric generation system, increasing natural gas-fired generation, installing emission control equipment, increasing its purchases of renewable energy, building solar facilities, and investing in energy efficiency initiatives to reduce energy use in the

Tennessee Valley. Additionally, TVA has invested to increase energy efficiency in its operations. The combination of more stringent environmental regulations, lower natural gas prices, and lower demand for energy across the Tennessee Valley has reduced the utilization of coal-fired generation. These factors have supported the reduction in emissions from the TVA system.

Clean hydro power is TVA's original energy source, and we continue to invest in clean sources of energy, including solar. Our award-winning utility-scale solar program is setting a standard for the industry. Called Green Invest, this program utilizes a unique public/private partnership structure and competitive bid process that enable the growth of affordable solar without shifting costs to non-participants under the Valley Public Power model. Additionally, Green Invest leverages the demand for utility-scale solar from business and industry for economic development in our communities. We expect to add between 7,000 and 10,000 megawatts of solar over the next two decades. We are also adopting the resources and technology necessary to support the ongoing growth of solar, including about 300 megawatts of energy storage pilot projects that are in the works.

We are modernizing our gas generation fleet to help reduce emissions and support high levels of reliability, given the intermittency of renewables. And in partnership with multiple other utilities in the Southeast, we are working to establish the Southeast Energy Exchange Market. This market could potentially help all participants in the Southeast realize a higher penetration of renewables by creating a bilateral market to exchange energy efficiently.

As we supply reliable energy, the efficiency and security of our transmission system are critical. TVA works around the clock to monitor and protect its critical cyber assets, partnering with other government agencies, as well as with industry groups and peers such as the Edison Electric Institute and neighboring utilities.

TVA has a comprehensive cybersecurity program aligned to industry best practices that operates to predict, protect, detect and respond to threats. Our focus is being proactive and using risk-based assessments to protect TVA. In addition to having multi-layered threat

analysis capabilities, we perform continuous monitoring, penetration testing and vulnerability assessments.

TVA's critical systems are housed within a specialized, isolated network that is separated from corporate networks and inaccessible from the internet. This segmentation provides a significant added level of security.

TVA trains its employees to recognize and resist cyber threats and also adheres to an array of industry and government standards, including National American Electric Reliability Corporation (NERC) Critical Infrastructure Protection (CIP) standards, Nuclear Regulatory Commission (NRC) security requirements and the Federal Information Security Management Act (FISMA).

As mentioned, our diverse generating system has helped us reduce our greenhouse gas emissions by about 60% from 2005 levels without negatively affecting customer prices or reliability. Our carbon-emission rate is 23% below our industry comparisons, based on the latest available 2019 data. Power rates and reliability are important to our customers, and our aspiration is to continue to lower our carbon emissions without affecting these critical metrics. In fact, we intend to hold energy costs flat for the next decade. Our reliability continues to serve our customers well, with 99.999% reliability since 2000. The value of that reliability was made clear just last month.

We saw the challenges that other parts of the country faced as a major winter storm made its way across Texas and other southern states in February. Millions of people were without electricity, many for several days; and the price of available energy during that time was extraordinary.

In the TVA region, the diverse generating portfolio we have developed served our customers well, as did our ongoing efforts to anticipate weather volatility and invest in winterizing our equipment. We have also increased our winter reserve margin from 20% to 25%, to better ensure uninterrupted service.

As a result, during the severe weather, the TVA power system delivered energy reliably, as designed, and at the cost we promised our customers, which is an effective rate lower today than it was 10 years ago. Our focus on investing in our system, maintaining stable rates, and taking appropriate actions goes back to our core principle of providing public power. We set rates as low as feasible, and we prioritize service to people and communities over profits.

The strength and value of the public power model can also be seen in TVA's response to the pandemic conditions of the past year. The value of public power and our commitment to serving local communities has been important during this challenging period.

Thanks to the outstanding efforts of TVA employees and employees of Valley local power companies, we were able to leverage TVA's strengths to ease the burden of pandemic conditions on the people we serve. After lowering rates in Fiscal Year 2020 for our local power company partners by 3.1%, in Fiscal Year 2021, our Pandemic Relief Credit is again reducing the wholesale energy bill for every local power company served by TVA, every large industrial customer we serve directly, and the large businesses and industries that are customers of our local power company partners.

This reduction is 2.5% each month throughout the fiscal year, putting $200 million back into communities in the form of retail rate reductions, bill assistance for those in need, upgraded system infrastructure to maintain reliability, and more.

We are also providing Back-to-Business incentives for large industrial and commercial customers, investing $12 million in credits so far to help businesses return to full operations and support economic recovery. To help local families and residents in need, we invested $4 million in a Community Care Fund. With generous contributions of matching funds by local power companies and others, the Community Care Fund has provided almost $8 million to help charitable organizations across the region address local needs through food banks, boxed-lunch programs for students, United Way, Boys and Girls Clubs, and other initiatives.

A SIGNIFICANT CHALLENGE AND OPPORTUNITY

Electricity is a significant portion of all the energy used in today's world, and that makes electricity a significant opportunity for decarbonization, as well. Electricity has grown from being just 3% of total final energy consumption in 1950 to approximately 21% of energy consumption in 2020.

If we continue to lower the greenhouse gas intensity of electricity without sacrificing reliability or low cost, electricity will be one of the keys to decarbonizing large sectors of the economy. Studies such as the Electric Power Research Institute's U.S. National Electrification Assessment predict that with efficient electrification, the contribution of electricity could rise to over 40% of final energy by 2050. As electricity's role grows, so will our customers' need for affordability and reliability.

We already see this in the rapid development of electric transportation technology. Electric utilities across the industry – working in partnership with the Edison Electric Institute – are supporting efficient electrification as a potentially cost-effective way to further reduce emissions, and transportation is the largest opportunity.

TVA and other utilities across the nation are working toward a clean energy transformation within their own vehicle fleets and through expanded networks of charging stations.

At TVA, we are partnering with the state of Tennessee to develop a statewide electric vehicle fast charging network. This network will power the growth of EVs across the state and increase consumers' confidence that they will have easy opportunities for refueling their electric vehicles. The first phase of this initiative, which targets achieving 200,000 electric vehicles in service by 2028, will reduce 1 million metric tons of CO_2 a year and save Tennesseans $200 million a year in fuel expenses.

For TVA and other utilities, our challenge, and our opportunity, is to not only lower the carbon emissions of our existing fleets but also to increase the availability of reliable and affordable low

carbon generating resources to support this broader economy-wide electrification effort. If we fail to do so, we will not realize the potential benefits of efficient electrification.

Establishing and maintaining the right balance between price, reliability, electrical generation CO2 reduction, and efficient electrification will help deliver a sustainable, economic advantage.

NUCLEAR ENERGY LEADERSHIP

As TVA leverages the strength of public power, continues to improve our operations, and further reduces carbon emissions, we know that efforts to achieve net zero carbon levels will require the preservation and extension of our existing nuclear fleet and the development of new technologies. This includes the development of energy storage options at a price significantly lower than the current market; carbon capture and sequestration; and advanced nuclear technologies such as small modular reactors.

While preserving and extending our current nuclear assets is critical, it is not sufficient, in my view. A January 2020 study regarding zero-emitting resources performed by E3 notes significant increase in power costs to maintain electricity supply reliability, with advanced nuclear being the lowest-cost option when approaching 100% carbon-free sources of generation due to the intermittency of renewables and the amount of oversupply required without nuclear.

Nuclear energy will be critical to speed the process of decarbonization without overtly sacrificing reliability or costs, and TVA is an industry leader in expanding nuclear generation. In 2016, TVA brought online the first new nuclear generation of the 21st Century, achieving commercial operation of the second unit at our Watts Bar Nuclear Plant – gaining an additional 1,150 megawatts of carbon-free energy for our system.

Today, our nearly 8,000-megawatt nuclear fleet is the backbone of our clean generation portfolio. We are investing in our existing fleet to continue to improve safety, increase power output, and extend unit operating life. For example, our Browns Ferry Nuclear Plant in Alabama recently earned national recognition for its multi-year Extended Power Uprate project, which

contributes an additional 465 megawatts of carbon-free energy to the TVA system. As we operate our nuclear fleet safely and efficiently, we are also investing in maintaining and upgrading our plants to support extending plant life by decades.

SMALL MODULAR REACTORS AND ADVANCED NUCLEAR

As a leader in nuclear energy, TVA is engaged today in developing new nuclear technology for tomorrow, which we believe to be an essential component of TVA's and the nation's decarbonization efforts. Enabling and accelerating new nuclear will take innovation and creativity, as well as old-school discipline and hard work. As a known technology with decades of similar operating experience to rely upon, light-water reactors will remain a key enabler of our ability to decarbonize our nation's energy supply, especially in the timeframes proposed.

I am proud to say that nuclear utilities across our industry are taking on this challenge.
In December 2019, TVA received the nation's first Early Site Permit for a small modular reactor from the U.S. Nuclear Regulatory Commission for two or more small modular reactors at our Clinch River Site in Oak Ridge, Tennessee. We are currently following the process related to evaluating the potential environmental impacts associated with deployment of more than one reactor and more than one design at the Clinch River Site to preserve our future options. Our team is actively engaged in technology assessment, working with technology developers to understand the costs and risks associated with construction and operation of various designs. When we select technology and begin site-specific engineering, it will be after extensive and careful planning and preparation.

In the past several years, the number of advanced nuclear designs under development has increased dramatically. The non-light-water designs hold promise. For these reactor types, more work needs to be done on fuel, supply chain development and NRC licensing; and the Department of Energy's recently announced Advanced Reactor Demonstration Program is an important supporting element. Development uncertainties for these designs, combined with the urgency to make meaningful progress toward decarbonization, led TVA to focus in the near-term on the next generation of small modular light-water reactor designs. We remain supportive of advanced reactor developers and want them all to be successful in order to provide long-term opportunities and competition in the energy marketplace. One non-light-water reactor developer has selected East Tennessee as its preferred location for a test reactor. While it does not have an NRC early site permit, we wish the project great success and look forward to supporting the developer.

As further development on this technology continues, it is important to look beyond the initial construction costs to the long-term costs associated with maintaining these important assets. While TVA does not believe a single-option, fully standardized design is in the best interest of the industry, we do believe that a larger adoption of fewer designs will create more benefits with lower operating and maintenance costs.

Overall, TVA believes nuclear technology plays a critical role in meeting electricity generation needs and carbon reduction goals in a manner that maintains reliability and keeps rates affordable. We believe light-water small modular reactors are the specific advanced nuclear technology most ready for deployment near-term.

TVA has the NRC-permitted Clinch River Site and a team doing the careful planning required to ensure that TVA has a viable option for this carbon-free resource available to the Tennessee Valley and the nation.

TVA's goal is to have a reliable, affordable, flexible and clean advanced reactor option available by 2032. Our path to this goal will be to make incremental investment decisions informed by continuous monitoring and analysis of our options. As mentioned, our Clinch River site is the only site in the nation with an NRC-approved early site permit for small modular reactors. This effectively eliminates a number of risks that have stopped or delayed many nuclear projects previously.

TVA has long been a leader in technology innovation and deployment in the electric power industry. We are applying this heritage to the new challenge of identifying the best options for the next generation of advanced nuclear. This is not a path that we can take alone. TVA is committed to partnering and collaborating with the many players who must be involved in this effort. Small modular reactors are ready for demonstration now – with the first commercial operation by 2030 possible, and multiple deployments possible in the 2030s. This would enable advanced nuclear to make a meaningful contribution to carbon reduction within the next two decades.

We will work to preserve and enhance the value of our Clinch River Site as a location to test and deploy new nuclear technologies. We will work with others in our industry to support policies, regulations and research that would further new nuclear development. And we will, through observation and some sweat equity, continue to monitor and support alternative technologies.

This comprehensive approach will increase the probability of TVA having a healthy array of options to meet our long-term decarbonization goals and perhaps move our nation closer to net-zero emissions at a cost everyone can afford.

CALL TO ACTION

Households typically spend 10% of their disposable income on energy; the greater availability of low-cost, reliable, clean electricity can lower that burden. More broadly, our collective goal should be to decarbonize energy generation and then to use this clean energy to reduce emissions across the economy through efforts such as TVA's electric vehicle initiative. Such improvements could be possible if we develop and use carbon-free nuclear energy as an essential part of our energy supply – electrifying the economy, driving down customer costs and eliminating carbon emissions.

In addition, a successful move into advanced nuclear technologies will reaffirm U.S. leadership in this important industry and potentially create opportunities to export U.S. nuclear products around the world as other nations confront these same environmental challenges.

With respect to new nuclear development, as with any new technology, there are challenges; and there are key needs that TVA and others must see satisfied before new nuclear moves forward:

- First, we must have the right product, one that is economically viable and competitive with other clean-energy alternatives.
- Second, we must take the right steps to reduce business and financial risks. Having the right amount of risk with first-of-a-kind nuclear is difficult. This requires us to identify and mitigate the risks during technology development and construction planning, so the project can be completed safely, on schedule and on budget and thereby build confidence for future projects.
- Third, we must have the right team, meaning a coalition of like-minded prospective partners who are committed to adoption of a specific technology that will achieve the needed operating and maintenance efficiencies over the life of the plant.
- Fourth, we must have the right business arrangements among the right participants. This would include the Department of Energy and industry participants who must share first-of-a-kind costs and risks so that ratepayers are properly protected.

At TVA, our first commitment is to the safe and efficient maintenance and operation of our existing nuclear fleet and other generating assets. Then, as we explore new nuclear technologies, we have the opportunity to demonstrate their worth to our region and the nation. TVA is hard at work on this front, and we already have some valuable assets to work with.

When TVA was founded in 1933, it was charged with developing technical solutions to address the economic and environmental challenges facing the people of the Tennessee Valley at the depths of the Great Depression. Since that time, TVA has become one of nation's leading electric utilities – and we have shared solutions across this nation and the world. Now, we have new economic and environmental challenges as the need for clean energy grows.

Together, TVA, the Department of Energy, and others have an opportunity to move toward an energy supply that is reliable and safe and supports long-term decarbonization goals for our region and the nation.

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