8120–08–P

TENNESSEE VALLEY AUTHORITY

Integrated Resource Plan

AGENCY: Tennessee Valley Authority.

ACTION: Issuance of record of decision.

SUMMARY: The Tennessee Valley Authority (TVA) has decided to adopt the preferred alternative in its final environmental impact statement (Final EIS) for the Integrated Resource Plan (IRP). The TVA Board of Directors approved the IRP and authorized staff to implement the preferred alternative at its August 22, 2019 meeting. This alternative, identified as the Target Power Supply Mix in the Final EIS, will guide TVA's selection of energy resource options to meet the energy needs of the Tennessee Valley region over the next 20 years. The energy resource options include continued investment in TVA's hydroelectric resources, license renewal for nuclear resources, expansion of solar and natural gas-fired generation, increased energy efficiency, demand response, and energy storage, and decreased coal-fired generation.

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SUPPLEMENTARY INFORMATION: This notice is provided in accordance with the Council on Environmental Quality's regulations (40 CFR 1500 to 1508) and TVA's procedures for implementing the National Environmental Policy Act (NEPA).

TVA is an agency and instrumentality of the United States, established by an act of Congress in 1933, to foster the social and economic welfare of the people of the Tennessee Valley region and to promote the proper use and conservation of the region's natural resources. One component of this mission is the generation, transmission, and sale of reliable and affordable electric energy. TVA operates the nation's largest public power system, providing electricity to nearly 10 million people in an 80,000-square mile area comprised of most of Tennessee and parts of Alabama, Georgia, Kentucky, Mississippi, North Carolina, and Virginia. It provides wholesale power to 154 independent local power companies and 58 directly-served large industries and federal facilities. The TVA Act requires the TVA power system to be self-supporting and operate on a nonprofit basis and directs TVA to sell power at rates as low as feasible.

Dependable generating capability on the TVA power system is approximately 37,500 megawatts (MW). TVA generates most of the power it distributes with 3 nuclear plants, 6 coal-fired plants, 9 natural gas-fired combustion turbine plants, 8 natural gas-fired combined-cycle plants, 29 hydroelectric plants, a pumped-storage hydroelectric plant, a diesel-fired facility, and 14 small solar photovoltaic facilities. TVA has gas-co-firing potential at one coal-fired site as well as biomass co-firing potential at its coal-fired sites. A portion of this delivered power is provided through long-term power purchase agreements. In fiscal year 2018, TVA efficiently delivered 163 billion kilowatt-hours of electricity to customers from a power supply that was 39 percent nuclear, 26 percent natural gas-fired, 21 percent coal-fired, 10 percent hydroelectric, and 3 percent wind and solar. The remaining one percent results from TVA programmatic energy efficiency efforts. TVA transmits electricity from generating facilities over 16,200 circuit miles of transmission

lines. Like other utility systems, TVA has power interchange agreements with utilities surrounding its service territory and purchases and sells power on an economic basis almost daily.

TVA completes IRPs to determine the most effective energy resource strategies that will meet demand for electricity in its service area over a 20-year planning period. The recently completed IRP updates TVA's 2015 IRP. Consistent with Section 113 of the Energy Policy Act of 1992, codified within the TVA Act, TVA employs a least-cost system planning process in developing its IRPs. This process takes into account the demand for electricity, energy resource diversity, flexibility, reliability, costs, risks, environmental impacts, and the unique attributes of different energy resources.

Future Demand for Energy

TVA uses state-of-the-art energy forecasting models to predict future demands on its system. Because of the uncertainty in predicting future demands, TVA developed high, medium, and low forecasts for both peak load (in MW) and annual net system energy (in gigawatt-hours, GWh) through 2038. Peak load is predicted to change at average annual rates of +0.3 percent in the medium-load forecast (Current Outlook Scenario), -0.7 percent in the low-load forecast, and +1.7 percent in the high-load forecast. Net system energy is predicted to remain flat in the medium-load forecast, decline at an average annual rate of 1.5 percent in the low-load forecast, and grow at an average annual rate of 2.0 percent in the high-load forecast.

Based on these load forecasts, TVA's current firm capacity (TVA generation, energy efficiency and demand response measures, and power purchase agreements), and including planning reserve margins of 17 percent for the summer peak season and 25

percent for the winter peak season, TVA would need additional energy resources in the future. The medium-load case needs are about 2,700 MW of additional capacity and effectively no additional energy by 2028, growing to about 5,600 MW and 1,700 GWh by 2038.

Alternatives Considered

Five alternative energy resource strategies were evaluated in the Draft EIS and IRP. These resource planning strategies were identified as potential alternative means of serving future electrical energy demands on the TVA system while meeting least-cost system planning requirements. These alternative strategies were:

Strategy A—Base Case (No Action Alternative): This strategy represents the continued implementation of the 2015 IRP, but also reflects subsequent decisions made by the TVA Board of Directors. This alternative incorporates TVA's current assumptions for resource costs and applies a planning reserve margin constraint, which also applies in every other strategy.

Strategy B—Promote Distributed Energy Resources (DER): This strategy is similar to the Base Case, but focuses on increasing the pace of DER adoption by incentivizing distributed solar and storage, combined heat and power, energy efficiency, and demand response.

Strategy C—Promote Resiliency: This strategy promotes higher adoption of small, agile capacity to increase the operational flexibility of TVA's power system, while also improving the ability to respond locally to short-term disruptions.

Strategy D—Promote Efficient Load Shape: This strategy promotes targeted electrification, demand response, and energy management to optimize load shape, including energy efficiency programs targeting low-income populations.

Strategy E—Promote Renewables: This strategy promotes renewables at all scales to meet growing prospective or existing customer demands for renewable energy.

The alternative strategies were analyzed in the context of six scenarios or future "worlds" that were determined to be reasonably possible to occur. The scenarios were TVA's Current Outlook, Economic Downturn, Valley Load Growth, Decarbonization, Rapid DER Adoption, and No Nuclear Extensions. Each scenario incorporates a set of uncertainties relevant to power system planning that include plausible future economic, financial, regulatory and legislative conditions, as well as social trends and adoption of technological innovations. Potential 20-year capacity expansion plans or resource portfolios were developed for each combination of alternative strategy and scenario using a capacity planning model. The model built each portfolio from a range of potential energy resource options that included TVA's existing energy resources and new nuclear, coal, natural gas, hydroelectric, wind, solar, and biomass generation, energy storage, energy efficiency, demand response, and electrification as well as facility retirement options. Each portfolio was optimized for the lowest Present Value of Revenue Requirements (PVRR) while meeting energy balance, reserve, operational, and other requirements. The portfolios were then evaluated using an hourly production costing program to determine detailed revenue requirements and near- and long-term system average costs. Recognizing the uncertainty in long-range planning studies, extensive stochastic analyses were also conducted to identify risk exposure within each scenario. Metrics were developed to rank the portfolios and

included financial risk, carbon dioxide emissions, water consumption, land use, coal waste generation and changes in regional personal income. These metrics were used to compare the alternative strategies and their associated portfolios.

Strategies A and B had similar scores for most metrics with the exception of total resource cost and environmental impacts. Higher total resource cost and lower environmental impacts for these two strategies is driven by the promotion of distributed resources.

Strategy C had slightly higher PVRR and system average costs than Strategies A and B and had moderate financial risk compared to other strategies. Strategy C had the lowest environmental impact overall, due to the largest amount of coal retirements across scenarios, but had high land use impacts due to the large amount of solar expansion. Flexibility scores were comparable to Strategies D and E.

Strategy D had the highest PVRR and system average cost due to the promotion of storage, was mid-range among the strategies in total resource cost, and had the highest risk exposure across all strategies. Strategy D had low environmental impact overall, but high land use impacts due to large solar expansion. Flexibility scores were comparable to Strategies C and E.

Strategy E had slightly higher PVRR and system average costs than Strategies A and B. Similar to Strategy C, Strategy E had moderate financial risk compared to other strategies. Strategy E had low environmental impact overall, but higher land use impacts due to large solar expansion. Flexibility scores were comparable to Strategies C and D.

These results were released in the Draft IRP and EIS for public review to solicit input and to better inform the development of the preferred alternative. In response to

public comments received on the Draft IRP and EIS, TVA conducted additional sensitivity analyses that varied key resource assumptions involving natural gas prices, capital costs, energy efficiency and demand response market depth, integration costs and flexibility benefits, pace and magnitude of solar additions, higher operating costs for coal plants, more stringent carbon constraints, and variation in climate. The results of these analyses supported the energy resource ranges identified in the initial portfolios.

TVA then developed a preferred alternative, the Target Power Supply Mix. In developing it, TVA took into account its least-cost planning requirement and customer priorities of power cost and reliability, as well as comments it received during the public comment on the Draft IRP and EIS. The Target Power Supply Mix establishes ranges of resource additions and retirements by the end of the first 10 years of the study (2028) and by the end year of the study (2038) in megawatts (MW). The recommended ranges are based on all scenarios and sensitivities evaluated, expressed over the 20-year planning period, with more specific direction over the first 10 years. The recommendation also highlights expectations under the Current Outlook Scenario based on TVA's current projections for key drivers such as electricity demand and commodity prices. Shifts in resource additions within the ranges would be based on key input variables, including changing market conditions, more stringent regulations, and technology advancements. The Target Power Supply Mix is described in detail in Section 3.8 of the Final EIS and in Section 9.4 of the Final IRP. Chapter 10 of the Final IRP describes near-term actions that TVA will take to implement the IRP and policy considerations that will guide the implementation of the IRP.

Public Involvement

TVA published a notice of intent to prepare the IRP EIS in the *Federal Register* on February 14, 2018 (83 FR 6668). TVA then actively engaged the public through public scoping and public briefings during the development of the IRP and EIS. TVA also established an IRP Working Group to more actively engage stakeholders. Group members included representatives of local power companies (distributors of TVA power), state agencies, direct-served customers, academia, and energy and environmental non-governmental organizations. Members of the group met frequently with TVA IRP staff to review and provide input during the development of the plan. In addition, the Regional Energy Resource Council, a Federal Advisory Committee, provided review and advice periodically throughout the process.

The Notice of Availability (NOA) of the Draft IRP and EIS was published in the *Federal Register* by the U.S. Environmental Protection Agency (USEPA) on February 22, 2019 (84 FR 5760). TVA accepted comments on the Draft IRP and EIS until April 8, 2019. During the comment period, TVA held seven public meetings and a public webinar to describe the project and accept comments. TVA received about 300 comment submissions signed by about 1,270 individuals and organizations. After considering and responding to these comments, further evaluating the alternative strategies, and developing the Target Power Supply Mix, TVA issued the Final IRP and EIS. The NOA for the Final IRP and EIS was published in the *Federal Register* on July 5, 2019 (84 FR 31268).

Following the publication of the NOA for the Final IRP and EIS, TVA received about 1,000 public comments via a form email through a Sierra Club campaign. These comments reiterated comments received on the Draft IRP and EIS and urged TVA to adopt the greatest amount of DER and renewable energy in the Target Power Supply Mix. Over

400 of these messages included statements added by the commenters. These statements did not raise issues of relevance to this IRP that were not previously raised in the comments on the Draft IRP and EIS and addressed by TVA in Appendix F of the Final EIS.

Environmentally Preferable Alternative

All of the alternative strategies, as well as the Target Power Supply Mix, have several common features that affect their anticipated environmental impacts. No baseload generation is added, but there is a need for new capacity in all scenarios to replace expiring or retiring capacity. Solar expansion plays a substantial role in all scenarios, and gas, storage and demand response additions provide reliability and/or flexibility. Emissions of air pollutants, including carbon dioxide, the intensity of carbon dioxide emissions, water use and consumption, and generation of coal waste decrease under all strategies. Although the differences between Strategies A through E are small, the impacts to most environmental resources are greatest for Strategy A (the No Action alternative) and least for Strategy C (Promote Resiliency), followed closely by Strategies B, D and E. The impacts of the Target Power Supply Mix span the range of Strategies A through E for most environmental and socioeconomic resources. An exception is the impact to land use, quantified as the land area needed to accommodate new generating and storage facilities, which is potentially greatest under the Target Power Supply Mix with the addition of up to 14,000 MW of solar capacity occupying up to about 103,000 acres (in a high-load forecast scenario). Under all strategies and the Target Power Supply Mix, at least 97 percent of the land area required for new generating and storage facilities would be occupied by solar facilities. Compared to other types of generation, the impacts of solar facilities to land-based resources are relatively small and of shorter duration as described in Sections 5.2.3

and 5.5.5 of the Final EIS. Given these conditions, Strategy C is the environmentally preferable alternative.

Decision

On August 22, 2019, the TVA Board of Directors adopted the preferred alternative, the Target Power Supply Mix. The Board also directed staff to monitor future developments to help determine when deviations from the recommended resource ranges should be made and to initiate an update to the IRP no later than 2024 and earlier if future developments make this appropriate.

Mitigation Measures

The reduction of environmental impacts was an important goal in TVA's integrated resource planning process and all of the alternatives assessed by TVA do that. Because this is a programmatic review, measures to reduce potential environmental impacts on a site-specific level were not identified. As TVA deploys specific energy resources, it will review and take measures to reduce their potential environmental impacts as appropriate. TVA's siting process for generation and transmission facilities, as well as processes for modifying these facilities, are designed to avoid and/or minimize potential adverse environmental impacts.

Potential impacts will also be reduced through pollution prevention measures and environmental controls such as air pollution control systems, wastewater treatment systems, and thermal generating plant cooling systems. Other potentially adverse unavoidable impacts will be mitigated by measures such as compensatory wetlands mitigation, payments to in-lieu stream mitigation programs and related conservation initiatives, enhanced management of other properties, documentation and recovery of cultural resources, and infrastructure improvement assistance to local communities.

Authority: 40 CFR 1505.2.

Dated: September 9, 2019.

John M. Thomas III,

Executive Vice President and Chief Financial Officer.

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