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TVA POWER SUPPLY FLEXIBILITY PROPOSAL
FINAL ENVIRONMENTAL ASSESSMENT

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Symbols, Acronyms, and Abbreviations

AC	Alternating current
BTU	British Thermal Unit
CAA	Clean Air Act
CC	Combined cycle
CCR	Coal combustion residuals
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CHP	Combined heat and power
CO	Carbon monoxide
CO_2	Carbon dioxide
CWA	Clean Water Act
DC	Direct current
DER	Distributed energy resources
EA	Environmental assessment
EE	Energy efficiency
EIS	Environmental impact statement
EO	Executive Order
EUC	End-use consumer
FRP	Flexibility Research Project
FY	Fiscal year
GHG	Greenhouse gas
GWh	Gigawatt-hour
HAP	Hazardous air pollutant
IRP	Integrated Resource Plan
kWh	Kilowatt-hour
LPC	Local power company
LTP	Long-Term Partnership
MSA	Metropolitan Statistical Area
MW	Megawatt
MWh	Megawatt-hour
NAAQS	National Ambient Air Quality Standards
NEI	National Emission Inventory
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NO_x	Nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
O_3	Ozone
$PM_{2.5}$	Particulate matter whose particles are less than or equal to 2.5 micrometers
PM_{10}	Particulate matter whose particles are less than or equal to 10 micrometers
PPA	Power purchase agreement
PSA	Power service area
PV	Photovoltaic
RCRA	Resource Conservation and Recovery Act
RICE	Reciprocating internal combustion engine
SO_2	Sulfur dioxide
TDEC	Tennessee Department of Environment and Conservation
TSCA	Toxic Substances Control Act
TVA	Tennessee Valley Authority

U.S.	United States
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USDOE	U.S. Department of Energy
USEIA	U.S. Energy Information Administration
USEPA	U.S. Environmental Protection Agency

CHAPTER 1 – PURPOSE AND NEED FOR ACTION

1.1 Proposed Action

The Tennessee Valley Authority (TVA) is proposing to provide enhanced power supply flexibility to local power companies (LPCs) within their respective power service areas (PSAs; Figure 1-1) that have entered into Long-Term Partnership (LTP) agreements with TVA. Under the terms of the Long-Term Agreement resolution approved by the TVA Board of Directors in August 2019, LPCs that enter into an LTP agreement ("Valley Partners") would be offered the option to generate a portion of their customers' power requirements.

1.2 Purpose and Need for Action

TVA is a self-financed, wholly owned corporate agency of the United States that serves a region that consists of parts of seven southeastern states. As a public power entity, TVA has no shareholders and receives no tax dollars. Under the TVA Act of 1933, as amended (the TVA Act), Congress charged TVA with advancing the social and economic welfare of the residents of the Tennessee Valley region. One of the most important ways that TVA fulfills its congressional mandate is by providing reliable, affordable electric power to its 154 municipal and cooperative LPCs. LPCs take delivery of electricity generated and transmitted by TVA and perform the distribution function for their approximately 10 million retail consumers of electricity. TVA also sells power to 58 directly served retail customers with large or unusual power requirements. TVA is mandated to provide power at rates as low as feasible.

The LTP agreements strengthen the contractual relationships between LPCs and TVA to ensure continued success of the public power model. The proposed action ("Flexibility Proposal") would implement the power supply flexibility option identified in the August 2019 Board resolution. Under the power supply flexibility option, TVA committed to develop, by a specified date, an option for power supply flexibility for Valley Partners to generate a portion of their energy. If TVA does not provide an agreeable power supply flexibility option by the specified date, LPCs have the option to terminate their LTP agreement.

TVA would benefit from the Flexibility Proposal because it would enhance the Valley's energy resource diversity and would be responsive to customer demand for renewable energy resources. These are objectives identified by TVA in its 2019 Integrated Resource Plan (IRP; TVA 2019a). The TVA region benefits from a diverse power system. As the economics of renewables and distributed energy resources (DER) continue to improve, operational agility will be increasingly important to successful integration of these resources into the generation portfolio. The appropriate level of flexible generation would provide Valley Partners sufficient flexibility to meet their customers' needs while ensuring that the financial health impact to TVA is at a level that fits within the current strategic financial plan.

Current wholesale power contracts between TVA and LPCs require that LPCs obtain their entire power requirements from TVA. For many years, LPCs have requested the flexibility to generate power. LPCs have indicated that some customers turn to third-party providers for generation services because the current wholesale power contract restricts the LPCs from providing those same services. Under the Flexibility Proposal, TVA would remain the full requirements provider, but Valley Partners would be allowed to provide generation services to their retail customers so as to remain their customers' trusted energy advisor and comprehensive power supplier. The proposal would potentially reduce costs for customers seeking generation solutions and would address customer demands for reductions of their carbon footprints.

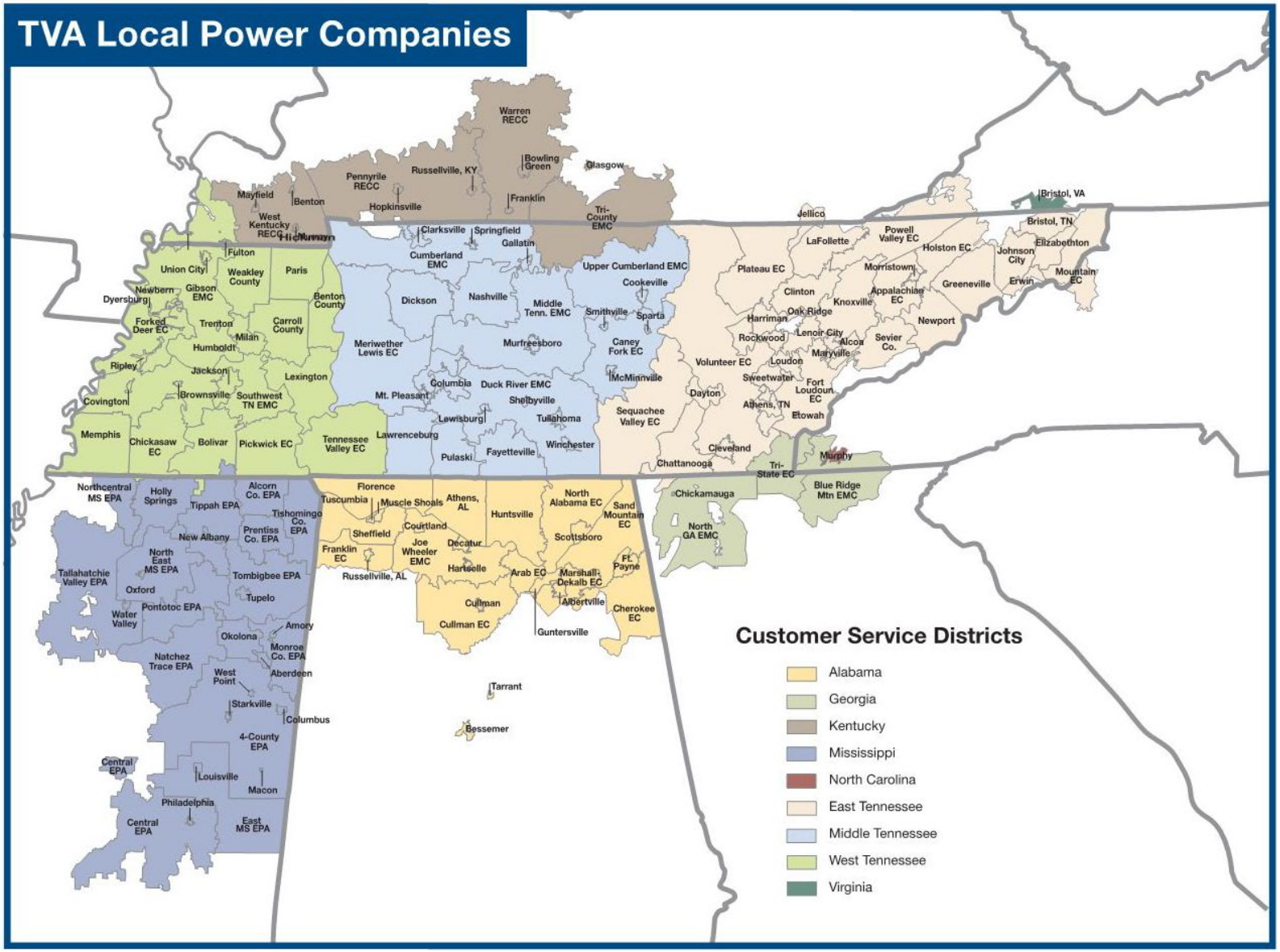

Figure 1-1. TVA and Local Power Company service areas

Additionally, the Flexibility Proposal would allow LPCs to lower their wholesale power costs through the reduction of monthly demand and energy charges.

1.3 Background

As noted above, the TVA Board approved the Long-Term Agreement resolution on August 22, 2019. The LTP agreements strengthen the contractual relationships between LPCs and TVA and secure the benefits of the public power model for decades to come. Key elements of the LTP agreements include long-term commitments, a partnership credit, rate adjustment protection, input to long-term planning, and power supply flexibility:

1. The long-term commitment established a 20-year term and termination notice requirement for the existing evergreen contracts between TVA and the LPCs. Previously, wholesale power contracts between TVA and individual LPCs had termination notice periods ranging from 5 to 20 years.
2. The partnership credit is based on the value of the long-term commitment to specific base charges. The credit is currently 3.1 percent applied to the base rate charges of the monthly wholesale power bills of Valley Partners.
3. Under the LTP agreements, if TVA implements rate increases to wholesale base rates that exceed thresholds specified in the agreements, Valley Partners may renegotiate the terms of, or withdraw from, the LTP agreement.
4. TVA has established a process of engagement with Valley Partners to gain input on strategic resource and financial planning decisions.
5. TVA committed to negotiating with Valley Partners to provide an option, by a specified date, for power supply flexibility for the partners to generate a specified portion of their energy. If TVA does not deliver a satisfactory power supply flexibility option by the specified date, LPCs have the option to terminate their LTP agreement.

Following the TVA Board approval of the Long-Term Agreement resolution in August 2019, TVA and LPCs began executing LTP agreements that included an initial commitment to collaborate to develop a plan of three to five percent flexible generation. The LTP agreements did not foreclose TVA from agreeing to an amount greater than three to five percent, and provided the LPCs the option to terminate the agreement if a flexibility plan was not developed by October 1, 2021. Over the course of several months of discussions, TVA and the Valley Partners developed the principles, criteria, and mechanisms that comprise the Flexibility Proposal. In February 2020, the TVA Board approved the Power Supply Flexibility resolution, which would allow Valley Partners to self-generate three to five percent of their energy.

TVA has previously worked with LPCs to address the demand for self-generation. TVA implemented two options consistent with the TVA public power model: the Flexibility Research Project (FRP) and Green Invest. The FRP is a Tennessee Valley Public Power Association (TVPPA) program jointly administered by TVPPA and TVA to meet consumer demand consistent with the all-requirements wholesale power contracts between TVA and LPCs on a demonstration basis, enabling both TVA and LPCs to evaluate the potential of such projects and assess system impacts. The FRP allows LPCs to build, own, and operate generation while maintaining buy-all/sell-all relationships. Up to 300 MW of flexible generation from solar, combined heat and power (CHP), and other applicable technologies is available to LPCs under the FRP. This option is open to all LPCs, regardless of whether they choose to become Valley Partners, until January 2021. The FRP does not provide reductions to monthly billing determinants as the Flexibility Proposal does, but is instead a modified power purchase agreement under which TVA purchases the power generated by the LPCs. Agreements under

the FRP have delivery durations limited to 20 years. To date, no FRP projects have been brought into operation.

The Green Invest program leverages long-term agreements to build new, large-scale renewable energy installations in the Valley. The program is open to LPCs, businesses, and industrial customers across TVA's service territory. Participation does not require the execution of an LTP agreement. The Green Invest program features power purchase agreements limited to 20 years in duration. Since 2019, several Green Invest projects have been initiated with 662 MW of renewable generation planned. All projects contracted in 2019 are solar facilities and would have similar impacts as those described in the 2019 IRP EIS and in this EA.

1.4 Proposed Decision

TVA has developed two alternative proposals (action alternatives) that would allow Valley Partners to generate a portion of their energy requirements. TVA must decide whether to implement one of the two action alternatives or the No Action Alternative. The two action alternatives and the No Action Alternative are described in Chapter 2.

1.5 Other Pertinent Environmental Reviews or Documentation

Pursuant to the National Environmental Policy Act (NEPA) of 1969 and its implementing regulations promulgated by the Council on Environmental Quality (40 Code of Federal Regulations §§ 1500-1508), federal agencies are required to evaluate the potential environmental impacts of their proposed actions. TVA has prepared this environmental assessment (EA) pursuant to NEPA and TVA's procedures for implementing NEPA (TVA 2020) to assess potential impacts associated with approval of the Flexibility Proposal. This EA tiers from the 2019 IRP Environmental Impact Statement (EIS) (TVA 2019a) and relies in part on that EIS analysis. Because the Flexibility Proposal establishes a "program" applying to any LPC that has a long-term agreement with TVA, the EA's analysis is largely generic in nature as site-specific information about the location or type of power generation resource LPCs would utilize is unknown.

Tiering to the 2019 IRP EIS allows TVA to rely on the assessment in that EIS of the IRP Power Target Supply Mix and the types of generation considered during its development. It allows TVA to tier its analysis to address more localized impacts that may occur based on likely LPC deployment scenarios. The 2019 IRP EIS provides general, non-site specific information in Section 5.2 about the environmental impacts of solar generating facilities over the range of capacities likely to be constructed for LPC flexible generation. Diesel- and coal-fired generation would be inconsistent with the 2019 IRP and nuclear generation at that scale would not likely be feasible.

The potential for expansion of DER within the TVA PSA was a key focus area in the development of the IRP, which was approved by the TVA Board in August 2019. The IRP process evaluates TVA's current energy resource portfolio and alternative future portfolios of energy resource options on a "lowest system cost" basis to meet the future electrical energy needs of the TVA region (TVA 2019a).

Several combinations of scenarios (plausible futures outside TVA's control) and strategies (alternative business approaches within TVA's control) were evaluated in the 2019 IRP. TVA considered the promotion of DER most explicitly under Strategy B ("Promote DER"). Under that strategy, TVA would focus on increasing the pace of DER adoption by incentivizing distributed solar generation and storage, CHP, energy efficiency, and demand response. High penetration

of distributed generation was also considered under the different scenarios evaluated in the IRP (TVA 2019a).

The Final IRP incorporated a Target Power Supply Mix as the preferred generation portfolio mix that included expansion of DER across the TVA region. While the IRP accounted for DER growth in the Valley by considering distributed generation and storage as resource options, it did not set specific capacity ranges for the expansion of DER or address specific programs that would implement distributed generation offerings by TVA and/or LPCs. Those programs were identified as implementation-level considerations and policy considerations that would be addressed later in time (TVA 2019a).

The programmatic analysis in the 2019 IRP EIS broadly addresses the potential impacts of future TVA power generation over the 20-year planning period. The analysis in the IRP EIS first describes the general process TVA uses to site new power facilities. It then describes the potential environmental impacts of the continued operation of TVA's generating facilities, facilities from which TVA purchases power through Power Purchase Agreements (PPAs), and the generating facilities that TVA is likely to own or purchase power from in the future. The EIS then describes the environmental impacts of energy efficiency programs and demand response programs (TVA 2019a).

In September 2014, TVA completed a Solar Photovoltaic Projects Programmatic EA addressing the potential impacts of constructing and operating small solar photovoltaic (PV) systems that provide power for the TVA system. The EA addressed greenfield solar facility development of sites covering up to 10 acres (generating approximately one to two megawatts [MW]) and brownfield development of sites covering up to 20 acres (generating approximately three to four MW) (TVA 2014).

1.6 Public Involvement

On April 3, 2020, TVA issued a draft of this EA for public review and comment. TVA provided notice to the public of the review period via a media advisory and outreach to key stakeholders. TVA posted the draft EA on its webpage (www.tva.gov/nepa) with information about how to submit comments. During the 30-day comment period, TVA received 12 comment submissions. Commenters include the states of North Carolina and Tennessee; Solar Energy Industries Association and its regional affiliate, the Tennessee Solar Energy Industries Association; Southern Alliance for Clean Energy; Southern Environmental Law Center (SELC); Tennessee Advanced Energy Business Council; Tennessee Valley Public Power Association; RKB Energy; and two individuals. Six other organizations cosigned the two letters submitted by SELC: Appalachian Voices, Center for Biological Diversity, Energy Alabama, Tennessee Chapter Sierra Club, Tennessee Interfaith Power and Light, and Vote Solar.

Some commenters expressed concern that five percent of energy sales (and the resulting power supply flexibility capacity of 800 MW) would not provide sufficient flexibility and these commenters recommended that TVA consider and evaluate alternatives with higher levels of flexibility in the EA. Some commenters expressed concern that capacity factors were not used in the analysis of the three deployment scenarios and recommended TVA consider the relatively low capacity factor of solar generation when determining allowable quantities of LPC generation. Others expressed concern that some LPCs may not have viable local options for generating resources and suggested LPCs be allowed to aggregate generating resources.

TVA considered these comments when completing the final EA and responded to substantive comments in Appendix B. As noted in the respective responses, TVA revised the EA as a result

of several comments to improve clarity and provide additional discussion and analysis of relevant issues.

1.7 Necessary Permits or Licenses

There are no state or federal permits or licenses required for TVA to undertake this action. Under the terms of the proposed action, LPCs or other project owners/operators would be responsible for obtaining the appropriate state and federal permits associated with the construction and operation of any generating facilities necessary to implement the Flexibility Proposal.

CHAPTER 2 – ALTERNATIVES

This chapter describes the alternatives analyzed in this EA, summarizes the environmental impacts associated with each alternative, identifies potential mitigation measures, and presents the preferred alternative.

2.1 Description of Alternatives

2.1.1 No Action Alternative

The No Action Alternative provides a baseline of conditions against which the impacts of the Proposed Action Alternative are measured. Under the No Action Alternative, TVA would continue to implement the LTP agreements and would continue to offer flexibility options such as the FRP until January 2021 and the Green Invest program. To date, no FRP projects have been brought into operation. To date, there is over 1,300 MW of renewable energy planned under the Green Invest framework; all projects contracted in 2019 are solar facilities and would have similar impacts as those described in the 2019 IRP EIS and in this EA. Under the No Action Alternative, Valley Partners would continue to rely on TVA for their entire power requirements. The Valley Partners would have the contractual option to terminate their LTP agreements after October 1, 2021. Based on feedback from Valley Partners, TVA estimates that fewer than 10 percent of the current 140 Valley Partners would terminate their LTP agreements if a flexible generation option is not adopted.

2.1.2 Alternative A

Under Alternative A (the "Proposed Action Alternative" in the draft of this EA), TVA would establish new agreements ("Flexibility Agreements") with LPCs that are Valley Partners to provide power supply flexibility, based on the following principles:

1. Valley Partners could have flexible generation of up to five percent of their average total hourly energy sales over the last five TVA fiscal years (FY 2015 to 2019), converted to capacity basis with a minimum availability of one MW per Valley Partner. TVA would calculate each LPC's average hourly wholesale load over the last five TVA fiscal years, multiplied by five percent. The calculated amount would never decrease for Valley Partners. A total of approximately 800 MW could be developed if all 154 LPCs across the Valley participate and develop their maximum allowable capacity. The largest LPCs have potential flexible generation of 70 to 80 MW, while 24 small LPCs have the 1-MW minimum potential flexible generation (Appendix A).
2. Flexible generation would be distribution scale[1] and located within the LPC service territory, except when circumstances such as restrictive siting can be demonstrated. Valley Partners would not be required to own or operate flexible generation assets themselves. LPCs could use a combination of different types of generation.
3. Flexible generation would be documented, metered, operated, and connected in a manner consistent with TVA standards. The Valley Partner would provide the location, fuel source, operating characteristics, and the maximum net capability of the flexible generators to TVA. TVA and Valley Partners would ensure the flexible generation projects are interconnected in a safe and reliable manner.
4. Flexible generation would reduce monthly demand and energy billing determinants during the month of generation for the term of the Flexibility Agreement. Generation

[1] Distribution scale generation generally refers to generation that LPCs may install within their five percent limitation and distribute within their service territory to end use customers.

would reduce the amount of power that would have otherwise been supplied to the LPC by TVA. TVA will remain obligated to provide the full power requirements of the Valley Partner. In certain exceptional circumstances, flexible generation may be treated in accordance with an economically equivalent crediting mechanism. The pricing of flexible generation would be the prevailing wholesale rate.

5. Flexible generation would be consistent with TVA's IRP to ensure that TVA's carbon position is improved. Consistent with DER identified in the 2019 IRP, community solar, rooftop solar, co-located solar and battery installations, natural gas-fired generators, and high efficiency natural gas-fired combined heat and power projects would be eligible. Diesel-fired or coal-fired generation technologies would not be eligible, due to their omission from the Target Power Supply Mix identified in the 2019 IRP. However, TVA would maintain discretion to eliminate natural gas-fired generation as a generation option if its system carbon position is not improved.

Provided that Valley Partners adhere to the above principles and the contract, which is built around these principles, TVA would not oversee or have approval authority over the generation resources acquired or constructed by Valley Partners. TVA would not conduct additional site-specific review of new facilities.

2.1.3 Alternative B

Based on continued internal deliberation, discussions with Valley Partners, and input obtained from the various stakeholders during the comment period on the draft EA, TVA developed an additional alternative. Under Alternative B, TVA would establish new Flexibility Agreements with LPCs that are Valley Partners to provide power supply flexibility that would incorporate principles 2 through 5 of Alternative A. Principle 1 of Alternative A would be replaced with the following:

1. Valley Partners could have flexible generation of up to five percent of their average total hourly energy sales over the last five TVA fiscal years (FY 2015 to 2019), converted to capacity basis with a minimum availability of one MW per Valley Partner. The calculated amount would never decrease for Valley Partners. TVA would apply a 0.4 technology factor to the nameplate capacity for solar installations, which would discount the flexible generation capacity allocation for solar generation by 60 percent. This factor would enable Valley Partners to self-generate approximately three percent of their total energy from solar generating facilities, consistent with the LTP agreement. It would also make the achievable level of generation from solar comparable to that of other sources. A total of approximately 800 MW could be developed if all 154 LPCs across the Valley participate and develop their maximum allowable capacity with resources other than solar. Approximately 2,000 MW could be developed if all 154 LPCs across the Valley participate and deploy only solar to develop their maximum allowable capacity. The potential flexible generation for the largest LPCs would range from 70 to 80 MW if other than solar, to 175 to 200 MW if only solar is deployed. For 24 small LPCs, the potential flexible generation would range from 1 MW if other than solar, to 2.5 MW if only solar is deployed.

To illustrate how this technology factor would be applied, consider a Valley Partner with a flexibility capacity allocation of 10 MW. If the partner wanted to fully deploy that available capacity using solar, it would be able to install 25 MW of solar generating capacity under Alternative B. Under Alternative A, this partner would have been limited to 10 MW of solar generating capacity. If this partner wanted to develop all of its available capacity with combined

heat and power or natural gas-fired generation, it would be limited to 10 MW as no technology factor is applied to these types of generation.

As with Alternative A, provided that Valley Partners adhere to the five principles and the contract, which is built around these principles, TVA would not oversee or have approval authority over the generation resources acquired or constructed by Valley Partners. Nor is it foreseeable where such facilities may be located.

2.1.4 Other Alternatives Considered but not Carried Forward

During the development of the proposed action, TVA considered other alternatives. However, upon further study, TVA determined that these other alternatives were not feasible for the reasons provided below.

2.1.4.1 Flexible Generation of Greater than Five Percent

TVA considered allowing Valley Partners to have flexible generation of greater than five percent of their average total hourly energy sales over the last five TVA fiscal years. When developing the LTP agreement, TVA had determined that the range of three to five percent balanced the risk of revenue erosion with the expected benefits of rate and financial stability from longer commitment periods. Introducing flexible generation at a level of three to five percent would allow TVA to implement this new concept at lower financial risk before contemplating expansion to higher levels of self-generation, using the lessons learned at the three to five percent level. As the principles, criteria, and mechanisms for implementing flexible power supply were developed in collaboration with the Valley Partners, it was apparent that using five percent of average total hourly power sales to calculate power supply flexibility would provide LPCs with substantially more flexibility than three percent of average total hourly power sales.

TVA also examined the potential impacts of using a percentage greater than five percent of average total hourly power sales. TVA considered the likely magnitude of the revenue erosion that would result from the Flexibility Proposal if implemented at flexibility levels higher than five percent. Under the Flexibility Proposal, TVA would compensate LPCs for their flexible generation by reducing the billable quantities on their monthly invoices by the monthly demand and energy from their flexible generation. Revenue erosion would be the expected consequence of this proposed method of compensation. If the option of flexible generation were only sparsely used by Valley Partners, its implementation would result in relatively little revenue erosion even at levels higher than five percent of average total hourly power sales. However, TVA anticipates that implementation of flexible generation will be widespread and that many LPCs would implement their entire allocations of flexible generation. Such broad implementation of flexible generation by Valley Partners would result in a higher degree of revenue erosion. Increasing the percent of average total hourly power sales eligible for the Flexibility Proposal even by a modest amount would result in a dramatic increase in revenue erosion. For instance, using six percent of average total hourly power sales rather than five percent of average total hourly power sales would result in a twenty percent increase in expected revenue erosion.

Higher revenue erosion could impose a risk to TVA's strategic financial plan. It could trigger a rate increase, necessitate a rate structure change, or inhibit TVA's ability to pay down debt. A rate increase in excess of the amounts identified in the Long-Term Agreement resolution could prompt the termination of the Agreement by any or all of the Valley Partners, resulting in a shift from 20-year contracts to 10-year contracts. TVA would lose the benefit of the 20-year notice period, and Valley Partners would lose the benefit of the partnership credit as well as some other LTP agreement benefits. A rate structure change would initiate an extended period of

complex negotiation with LPCs. For these reasons, this alternative was eliminated from further consideration.

2.1.4.2 Expansion of the TVA Flexibility Research Project

TVA considered expanding the Flexibility Research Project, a flexibility option consistent with the TVA public power model that was implemented in 2019. The FRP was approved to meet consumer demand consistent with the all-requirements wholesale power contracts between TVA and LPCs on a demonstration basis to enable both TVA and LPCs to evaluate the potential of such projects and to assess system impacts. The FRP allows LPCs to build, own, and operate generation while maintaining buy-all/sell-all relationships. Up to 300 MW of flexible generation from solar, combined heat and power, and other applicable technologies has been available to LPCs under the FRP. An expanded option could match the 800 to 2,000 MW of flexible generation considered under the Flexibility Proposal. This option is and will remain open to all LPCs until January 2021 regardless of their choice to become Valley Partners. However, the FRP does not provide reductions to monthly billing determinants as the Flexibility Proposal does but instead involves a modified power purchase agreement under which TVA purchases the power generated by the LPCs. Agreements under the FRP have delivery durations limited to 20 years. The FRP remains poorly subscribed and has not yet seen any projects brought into operation. For these reasons, this alternative was eliminated from further consideration.

2.2 Comparison of Alternatives

This EA evaluates the potential environmental effects that could result from implementing each alternative. The analysis of impacts in this EA is based on the current and potential future conditions throughout the TVA PSA. Most of the impacts of Alternatives A and B are indirect impacts that would result from the actions of participating LPCs through their construction and operation of flexible generation. A comparison of the impacts of the alternatives is provided in Table 2-1.

Table 2-1. Comparison of Impacts by Alternative

Resource Area	Impacts by Alternative		
	No Action Alternative	**Alternative A**	**Alternative B**
Energy Production and Use	No direct or indirect impacts anticipated.	Total installed capacity of up to approximately 800 MW.	Total installed capacity of up to approximately 2,000 MW. Increased solar generation would offset a larger amount of natural gas-fired generation than Alternative A.
		Negligible change in energy production and use due to the relatively small proportion of TVA's overall generating capacity that would be provided by LPCs under the Proposed Action.	
Socioeconomics	No direct or indirect impacts anticipated.	Short-term beneficial economic impacts would result from construction of generation facilities, including the purchase of materials, equipment, and services and a temporary increase in employment, income, and population.	Greater short-term beneficial economic impacts would result from increased construction of solar generation facilities, including the purchase of materials, equipment, and services and a temporary increase in employment, income, and population.
		Beneficial impacts to customers of participating LPCs.	
		Temporary, minor adverse noise impacts to minority and low-income populations could occur during the construction and operation of natural gas-fired generation facilities.	

Resource Area	Impacts by Alternative		
	No Action Alternative	**Alternative A**	**Alternative B**
Air Resources	No direct or indirect impacts anticipated.	Long-term beneficial impacts to air quality are anticipated due to the overall reduction of emissions.	Greater long-term beneficial impacts to air quality are anticipated due to increased solar generation that would offset a larger amount of natural gas-fired generation.
		Temporary emissions of air pollutants and greenhouse gas (GHG) expected during construction would be negligible.	
Water Resources	No direct or indirect impacts anticipated.	Any system-wide change in water usage and wastewater discharges would be negligible.	
Land Resources	No direct or indirect impacts anticipated.	Solar generation would require up to about 6,900 acres of land under Deployment Scenario 1, up to 6,200 acres under Deployment Scenario 2, and up to 3,440 acres under Deployment Scenario 3.	Solar generation would require up to about 17,250 acres of land under Deployment Scenario 1, up to 15,525 acres under Deployment Scenario 2, and up to 8,625 acres under Deployment Scenario 3.
		Minor direct adverse impacts on land resources are anticipated.	
Waste Generation	No direct or indirect impacts anticipated.	Generation of up to 224,000 cubic yards of packaging materials for solar facilities could occur under Deployment Scenario 1, up to 201,600 cubic yards under Deployment Scenario 2, and up to 112,000 cubic yards under Deployment Scenario 3.	Generation of up to 560,000 cubic yards of packaging materials for solar facilities could occur under Deployment Scenario 1, up to 504,000 cubic yards under Deployment Scenario 2, and up to 280,000 cubic yards under Deployment Scenario 3.
		No adverse impacts to waste management are anticipated with the use of best management practices.	

2.3 Identification of Mitigation Measures

TVA has not identified any mitigation measures necessary to offset or reduce the impacts of the alternatives.

2.4 The Preferred Alternative

TVA's preferred alternative is Alternative B. This alternative provides a level of flexible generation to Valley Partners that is sufficient to meet their customers' needs while also ensuring that the financial health impact to TVA is at a level that fits within the current strategic financial plan. The alternative also provides an allocation methodology to partially mitigate relatively low solar capacity factors, which was an issue of concern to Valley Partners and other stakeholders.

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CHAPTER 3 – AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the existing environmental, social, and economic conditions of the Project and the surrounding areas that may be affected if the No Action Alternative or either action alternative is implemented. This chapter also describes the potential environmental effects that could result from implementing each alternative.

3.1 Framework for Environmental Impact Analyses

In order to develop a more robust impact analysis, TVA has made reasonable assumptions concerning the types and scale of flexible generation that LPCs are likely to deploy. These assumptions support TVA's analysis and are based on discussions with LPCs and end-use customers, industry trends, and input TVA received during the development of the IRP. While it is uncertain at this time whether all 154 LPCs will choose to become Valley Partners, most have, to date, done so and the analysis in this EA is based on the assumption that all LPCs would do so. The analysis considers the maximum potential impacts of flexible generation. The analysis assumes a total of approximately 800 MW of flexible generation under Alternative A, with the potential for up to 2,000 MW of installed solar generation under Alternative B. The types of flexible generation are likely to vary among LPCs due to their different system requirements, customer preferences, and other factors. In order to encompass the potential range of variability, this EA analyzes three deployment scenarios for both Alternative A and Alternative B:

Deployment Scenario 1: 100 percent solar;

Deployment Scenario 2: 90 percent solar and 10 percent natural gas-fired generation; and

Deployment Scenario 3: 50 percent solar and 50 percent natural gas-fired generation.

The three deployment scenarios bound the range of the proportions of solar generation and natural gas-fired generation (including natural gas-fired CHP) that is likely and that would ensure that TVA's carbon position is improved. Based on discussions with participating LPCs, TVA considers Deployment Scenario 2 to be the most likely deployment scenario.

Potential solar installations are expected to utilize various configurations of PV panels, including ground-mounted multi-MW and smaller 1-MW installations on fixed-tilt and single-axis tracking mounting racks; rooftop-mounted, sub-1-MW installations on commercial and industrial buildings; and dispersed small residential installations. Rooftop-mounted installations require no additional land. Based on characteristics of recently constructed and proposed solar installations in the TVA region and elsewhere in the southeast, ground-mounted installations require an average of about 7.2 acres/MW_{AC} (6.1 acres/MW_{DC}) for fixed-tilt systems and 8.6 acres/MW_{AC} (7.3 acres/MW_{DC}) for single-axis tracking systems (TVA 2019a). Generally, developable sites must be relatively flat, not shaded by trees or tall buildings, and preferably close to an LPC's electrical transmission or distribution line that will connect to the facility. Construction activities include clearing the site of tall vegetation, grading as necessary to have a flat site profile, installation of electrical cables in trenches to connect arrays of PV panels, DC to AC inverters and power transformers, installation of metal mounting racks supported by metal posts driven into the ground by drilling or use of a pile driver, fastening PV panels to mounting racks, enclosing the site with security fencing, revegetating the site with low-growing vegetation, and connecting the facility to the LPC's electrical system.

Most existing and proposed solar installations in the TVA region have been constructed on land that was previously farmed. A small proportion (less than 3 percent) are on previously developed, brownfield sites including closed landfills and former industrial facilities. Solar facilities developed on these sites typically require special mounting racks that do not penetrate the ground surface and increase their development costs. These sites are, however, often available in urban areas where suitable undeveloped, greenfield sites may not be readily available.

Some solar generation is likely to be community solar, which is targeted at residential and commercial customers interested in solar power but which, for various reasons, customers are unable or unwilling to install on their own. These customers could participate in a variety of financial structures, but generally would purchase a portion of a solar facility constructed and operated by the LPC and receive a credit on their subsequent power bills proportional to the amount of solar energy generated through their investment in the community solar facility. Ten LPC-operated community solar facilities are currently operating in the PSA. The individual facilities range from 0.025 to 4.25 MW_{AC} in capacity.

Potential natural gas-fired generation systems installed under the Flexibility Agreements are expected to be stand-alone systems operated primarily during times of peak demand, or combined heat and power (CHP) systems.

Stand-alone systems would likely be reciprocating internal combustion engine (RICE) generator sets, which utilize a multiple-cylinder spark-ignition engine to drive a generator. RICE generator sets are available in a range of sizes up to about 20 MW capacity. Multiple generator sets can be co-located to provide increased capacity. Many models can be configured to operate on renewable landfill gas or digester gas. RICE generator sets are typically installed in buildings with, depending on the local setting, additional measures such as insulation, exhaust silencers, and low noise radiators necessary to reduce noise emissions. RICE generator sets such as the Wartsila 18V50SG, analyzed as a supply option in the 2019 IRP (TVA 2019a), are capable of operating at efficiencies of up to about 50 percent and heat rates of 8,266 BTU/KWh at summer full load. LPC-installed RICE generator sets are likely to be sited in industrial areas or adjacent to existing electrical substations. Suitable sites require access to a natural gas (or renewable gas) supply and a source of water for the generator set cooling system.

CHP systems, also known as cogeneration systems, produce electricity and thermal energy (heat) that is used for heating, cooling, steam generation for industrial processes, and other purposes. They are best suited for applications with steady thermal and electrical loads. CHP systems are typically located at the point of consumption of the thermal energy, which may be an industrial plant, university campus, hospital, prison, or other facility (USDOE 2017), and the electricity may be utilized by the associated facility or fed into the local electrical grid. Because CHP systems recover thermal energy that would otherwise be wasted, they operate at high efficiencies of 60 to over 80 percent, significantly higher than stand-alone electrical generators and boilers that would otherwise provide the electricity and thermal energy (USDOE 2017). Emissions of air pollutants are also consequently lower. Most CHP systems operated by LPCs are expected to be between 1 and 8 MW and fueled by natural gas, which drives a gas turbine or reciprocating engine attached to a generator and heat recovery unit. An alternative configuration would fuel a boiler or other industrial process with natural gas and use the rejected heat to generate electricity. This configuration is often used with solid fuels such as biomass and waste from the associated industrial process. RICE- and gas turbine-powered CHP systems can be configured to operate on landfill gas or digester gas. While the majority of U.S.

CHP installations utilize reciprocating engines, gas turbine systems provide about two-thirds of U.S. CHP generating capacity (USDOE 2017).

TVA would not have approval authority over LPC generation resources that may be adopted under the Flexibility Proposal. Therefore, this EA addresses the potential impacts of the construction and operation of the flexible generation resources under the control of the LPCs in a generic non-site specific context and to the extent those impacts are foreseeable. It also addresses the impacts of the flexible generation resources on the overall environmental performance of the TVA power system.

The EA addresses the following general resource topics and includes a summary of relevant IRP EIS analysis by topic and analysis that addresses foreseeable LPC generation (given size restriction), to the extent practical:

- Energy Production and Use;
- Socioeconomics;
- Air Resources;
- Water Resources;
- Land Resources; and
- Waste Generation.

TVA notes that the effects of the proposed action on the physical environment depend on decisions made by entities outside of TVA's direct control. Because TVA cannot predict how or even when LPC decisions relating to generation would be made, the assessment of potential impacts on the physical environment involves some degree of speculation.

3.2 Energy Production and Use

This section describes an overview of TVA's current and projected future energy generation system, as described in the 2019 IRP and associated EIS (2019a), and the potential impacts to energy production and use that would be associated with each alternative.

3.2.1 Affected Environment

3.2.1.1 Overview

TVA is the largest producer of public power in the U.S. and provides wholesale power to 154 LPCs and directly sells power to 58 industrial and federal customers. TVA's power system, with a generating capacity of approximately 38,000 MW, serves nearly 10 million people in a seven-state, 80,000-square-mile region (Figure 1-1). TVA's PSA includes most of Tennessee and portions of Alabama, Georgia, Kentucky, Mississippi, North Carolina, and Virginia. TVA's generating assets include: five coal-fired plants, three nuclear plants, 29 conventional hydroelectric plants, one pumped storage hydroelectric plant, nine natural gas-fired combustion turbine (CT) gas plants, eight natural gas-fired combined cycle (CC) gas plants, one diesel-fired generator site, and 14 solar energy sites. In total, these assets constitute a portfolio of 33,500 MW. The remainder of delivered power is provided through long-term PPAs. TVA transmits electricity from these facilities over 16,000 circuit miles of transmission lines. Like other utility systems, TVA has power interchange agreements with utilities surrounding its region and purchases and sells power on an economic basis almost daily (TVA 2019a).

Consumers of TVA-generated electricity are a mix of residential, commercial, and industrial end-use consumers (EUCs) in the PSA. Recent (2015-2018) energy sales totaled between 155,000

and 163,000 gigawatt-hours (GWh) annually, with sales in FY 2019 of approximately 163,000 GWh. Energy generation in FY 2019 is summarized in Figure 3-1.

The 2019 IRP found that in the current outlook scenario, future capacity requirements were similar to current requirements until the end of the 20-year planning horizon; at that time, required capacity was projected to increase slightly. However, the IRP reports that new generation resources will be needed to replace facilities that will be retired or power purchase agreements that will expire over the planning horizon.

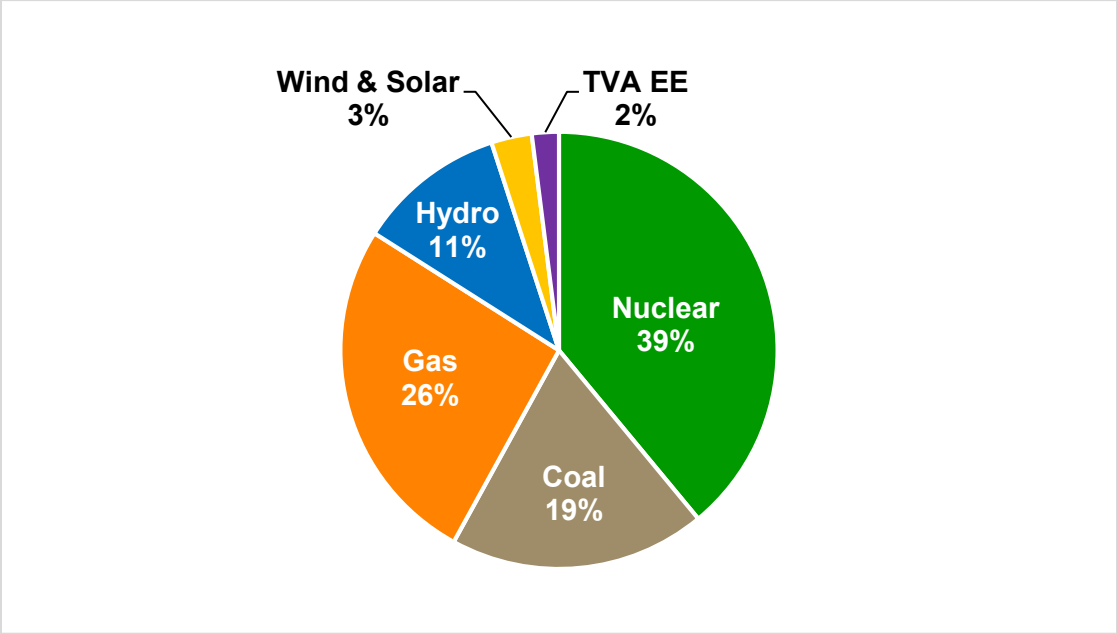

Figure 3-1. TVA FY 2019 Energy Generation

3.2.1.2 Renewable Energy in the TVA PSA

TVA's renewable energy generation in FY 2019 consisted of hydroelectric (11 percent), wind, and solar (a combined 3 percent; Figure 3-1). In FY 2019, TVA generated less energy from fossil fuels (45 percent) than the national average of 64 percent (USEIA 2019). As discussed in the 2019 IRP, TVA expects to increase the generation of renewable energy, specifically utility-scale solar, while decreasing generation from fossil fuels.

3.2.2 Environmental Consequences

This section describes the potential impacts to energy production and use should the No Action Alternative or either action alternative be implemented.

3.2.2.1 No Action Alternative

Under the No Action Alternative, TVA would continue to implement the LTP agreements but would not offer power supply flexibility options. Valley Partners would continue to rely on TVA for their entire power requirements. Current and projected future energy generation would be as described in the 2019 IRP and associated EIS.

3.2.2.2 Alternative A

Under Alternative A, TVA would establish Flexibility Agreements with Valley Partners to provide power supply flexibility with the Valley Partner LPCs providing up to approximately 800 MW of

generating capacity that would otherwise be provided by TVA. CHP generation, which is capable of providing continuous, baseload generation, would offset generation that would otherwise be provided by natural gas-fired combined cycle and coal-fired generators. Solar and RICE generating capacity provided by LPCs under the three deployment scenarios noted above during the early years of the 20-year IRP planning period would largely offset natural gas-fired generation that would have been provided by TVA. During the later years of the IRP planning period, LPC solar and RICE generation would offset both TVA natural gas-fired and solar generation. However, due to the relatively small proportion of TVA's overall generating capacity that would be provided by LPCs under Alternative A, and particularly LPC natural gas-fired generation, Alternative A is unlikely to markedly alter the TVA long-term power supply plan (TVA 2019a) or the timing of the construction of new generating capacity and retirement of existing generating capacity.

3.2.2.3 Alternative B

Under Alternative B, the impacts to energy production and use would be similar to those of Alternative A except the total installed capacity could increase to a maximum of approximately 2,000 MW under Deployment Scenario 1. Under all three deployment scenarios, the increased solar generating capacity would offset a larger amount of natural gas-fired generation that would have been provided by TVA than under Alternative A. As with Alternative A, Alternative B is unlikely to markedly alter the TVA long-term power supply plan (TVA 2019a) or the timing of the construction of new generating capacity and retirement of existing generating capacity.

3.3 Socioeconomics

This section describes an overview of the existing socioeconomic conditions in the TVA PSA, as described in the 2019 IRP and associated EIS, and the potential impacts to socioeconomic conditions that would be associated with each alternative.

3.3.1 Affected Environment

3.3.1.1 Overview

The estimated population of the TVA PSA was 10.3 million in July 2017, a 4.4 percent increase from July 2010. TVA projects that the rate of population increase in the TVA PSA will slow in the coming decades. Population density varies substantially among counties in the TVA PSA, which contains a mix of rural and metropolitan areas. The larger population concentrations tend to be located along major river corridors. Approximately 67.6 percent of the population of the TVA PSA lives in defined metropolitan statistical areas (MSAs). As of July 2017, there are four MSAs with populations over 500,000, all located in Tennessee: Nashville (1.9 million), Memphis (1.3 million), Knoxville (877,000), and Chattanooga (557,000). The largest metropolitan area in the TVA PSA located outside of Tennessee is Huntsville, AL, with a population of 455,000 as of July 2017 (TVA 2019a).

Under the TVA Act, Congress charged TVA with advancing the social and economic welfare of the residents of the Tennessee Valley region. This is evidenced by low cost, reliable power benefitting industrial customers and economic growth, as well as the amount of capital investment in the TVA PSA. Capital investments include investments in the overall power system, such as funding for new and existing generating plants and general system improvements (TVA 2019a).

Selected social, demographic, and economic characteristics for the TVA PSA and the U.S. are presented in Table 3-1. Primary observations include:

- The population of the TVA PSA is slightly older and includes a higher proportion of

persons self-identifying as “white alone” than in the U.S. as a whole;

- The economy of the TVA PSA has a slightly higher percentage of workers employed in “blue collar” occupations such as natural resources, construction, production, and transportation than the nation as a whole, and the proportion of persons with at least a high school degree is 84.7 percent, slightly lower than the national average; and
- The unemployment rate in the TVA PSA and the proportion of persons below the poverty level are higher than the national average, and per capita income is lower than the national average.

Table 3-1. Selected 2016 Social, Demographic, and Economic Characteristics

Characteristic	TVA PSA	U.S.
Median Age	40.8	37.7
Age 65 or Older	15.3%	14.5%
High School or Higher	84.7%	87.0%
Minority	26.3%	38.7%
Unemployment Rate*	7.7%	5.8%
Per capita income	$42,578	$51,640
Below Poverty Level	19.7%	12.7%
Employment in Management, Business, Science, and Arts Occupations	32.9%	37.0%
Employment in Service Occupations	16.8%	18.1%
Employment in Sales and Office Occupations	24.1%	23.8%
Employment in Natural Resources, Construction, and Maintenance	9.4%	8.9%
Employment in Production, Transportation, and Material Moving	16.8%	12.2%

Source: TVA 2019a
*The TVA PSA and U.S. unemployment rates have declined since 2016

3.3.1.2 Minority and Low-Income Populations

Environmental justice-related impacts are analyzed in accordance with Executive Order (EO) 12898 to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of federal programs, policies, and activities on minority and low-income populations. While not subject to this EO, TVA routinely considers environmental justice in its NEPA review processes.

The 2019 IRP EIS presents recent information about the geographical distribution of low-income and minority populations within the TVA PSA. Because the alternatives considered herein would apply throughout the TVA PSA, this EA summarizes region-wide information. As indicated in Chapter 4 of the 2019 IRP EIS, minority populations comprise a lower proportion of the total regional population than that of the U.S. population. The proportion of the regional population that is below poverty level (i.e., low-income) is higher than the national proportion. Refer to TVA (2019a) for more detailed information.

This EA also incorporates by reference TVA's 2018 Wholesale Rate Change EA, which discusses energy use and the proportion of income spent on energy in the context of low-income and minority populations. The 2018 Wholesale Rate Change EA discusses that, in general, low-income households tend to use less energy than higher-income households but spend a higher proportion of their incomes on energy bills. Also within the TVA PSA, minority households are more likely to be low-income households than non-minority households (TVA 2018).

3.3.2 Environmental Consequences

This section describes the potential impacts to socioeconomic resources should the No Action Alternative or either action alternative be implemented.

3.3.2.1 No Action Alternative

Under the No Action Alternative, TVA would continue to implement the LTP agreements but would not offer power supply flexibility options. Valley Partners would continue to rely on TVA for their entire power requirements. There would not be a temporary increase in employment, income, and population because there would not be increased construction of solar generation facilities. Valley Partners would not be able to reduce costs to larger customers or address customer demands for an electrical supply with lower or no carbon emissions. Additionally, some LPCs would not be able to manage their own costs through the reduction of monthly peak demand and, by extension, their wholesale power bill.

3.3.2.2 Alternative A

Under Alternative A, TVA would establish Flexibility Agreements with Valley Partners to provide power supply flexibility. The five percent cap (and system-wide total cap of 800 MW) on energy generated by participating LPCs was selected by TVA, in part, because it would have little effect on TVA costs and the rates paid by TVA customers. The deployment scenarios utilized by the participating LPCs are likely to vary according to their customer demands. Subscriber-based community solar programs, a likely component of all three deployment scenarios, would have little to no effect on the energy bills of non-participating LPC customers and would have minimal socioeconomic impacts. Most residential community solar subscribers would likely be middle- to higher income households, as the required initial investment would deter many low-income households.

The cost of CHP generation under Deployment Scenarios 2 (90 percent solar and 10 percent natural gas) and 3 (50 percent solar and 50 percent natural gas) would largely be borne by the industrial, commercial, or institutional facility receiving the thermal energy and the LPC and would have little to no effect on the energy bills of other LPC customers. The CHP generation would have beneficial economic impacts to the host facility through the long-term reduction in the cost of producing the thermal energy necessary for operating the facility.

The costs of constructing and operating stand-alone natural gas-fired generation under Scenarios 2 and 3 would likely be borne by all of the LPC's customers. Over time, there could be minor cost savings to the LPC and its customers if the LPC's stand-alone gas-fired generation displaces higher cost TVA generation, particularly during times of peak energy demand.

Alternative A is not expected to result in any adverse economic impacts and would likely have small beneficial impacts to the customers of participating LPCs. The construction of the generating facilities by participating LPCs would result in minor, localized, short-term increases

in employment and the associated purchase of goods and services. Increases in employment for the operation of the generating facilities would be negligible.

The construction and operation of solar generation facilities is unlikely to result in any disproportionate adverse impacts to minority and low-income populations. The construction and operation of natural gas-fired generation facilities could adversely affect minority and low-income populations, primarily from noise during facility operation. Compliance with local zoning ordinances and local and Occupational Health and Safety Administration noise standards would reduce this potential.

3.3.2.3 Alternative B

Under Alternative B, the impacts to socioeconomics would be similar to those of Alternative A except that the increased potential solar generating capacity would result in greater short-term increases in employment and the associated purchase of goods and services during construction of the solar generating facilities by participating LPCs.

3.4 Air Resources

This section describes an overview of the existing air quality and greenhouse gas (GHG) emissions in the TVA PSA, as described in the 2019 IRP and associated EIS, and the potential impacts on air quality and GHG emissions that would be associated with each alternative.

3.4.1 Affected Environment

Ambient air quality is determined by the type and concentration of pollutants emitted into the atmosphere, the size and topography of the air shed in question, and the prevailing meteorological conditions in that air shed. Through its passage of the Clean Air Act (CAA) of 1970 and its amendments, Congress mandated the protection and enhancement of our nation's air quality. The U.S. Environmental Protection Agency (USEPA) established the National Ambient Air Quality Standards (NAAQS) for the following criteria pollutants to protect the public health and welfare: sulfur dioxide (SO_2), ozone (O_3), nitrogen dioxide, particulate matter whose particles are less than or equal to 10 micrometers (PM_{10}), particulate matter whose particles are less than or equal to 2.5 micrometers ($PM_{2.5}$), carbon monoxide (CO), and lead. These NAAQS reflect the relationship between pollutant concentrations and health and welfare effects. Areas not meeting the standards are called "nonattainment" areas. There are no nonattainment areas designated within the TVA PSA.

TVA coal-fired and natural gas-fired electric generating facilities either directly emit these pollutants or contribute to their formation (O_3 and $PM_{2.5}$) in certain atmospheric conditions. Generally, TVA's hydroelectric, nuclear, and renewable energy facilities do not directly contribute to air emissions. TVA has installed air emission controls at its fossil-fueled facilities to reduce air emissions. These emission controls include flue gas desulfurization ("scrubbers"), selective catalytic and non-catalytic nitrogen oxide (NO_x) reduction systems, and particulate control systems (TVA 2019a).

Hazardous air pollutants (HAPs) are those that are listed under Section 112(b) of the CAA because they present a threat of adverse human health effects or adverse environmental effects. The CAA requires the USEPA to regulate HAPs from listed categories of industrial facilities. HAPs are toxic air pollutants, which are known or suspected to cause cancer or other serious health effects or adverse environmental conditions. The CAA identifies 187 pollutants as HAPs. Most HAPs are emitted by human activity, including motor vehicles, factories, refineries, and power plants. Mercury is the HAP compound most associated with the burning of coal and power plant emissions. Other important issues concerning power plant emissions include acid

deposition related to SO_2 and NO_x emissions and visibility impairment, which, in the TVA region, is related mostly to ammonium sulfate particles formed from SO_2 emissions from coal-fired power plants. The most sensitive areas in the region are high elevation, forested areas such as the Great Smoky Mountains National Park (TVA 2019a). The nature of these pollutants, their effects, and their relationships to power production and industry are discussed more fully in the 2019 IRP EIS (TVA 2019a).

Greenhouse gases (GHGs) occur in the atmosphere both naturally and as a result of human activities, such as the burning of fossil fuels. GHG emissions due to human activity are the primary cause of increased atmospheric concentration of GHGs since the industrial age and are the primary contributor to climate change. The primary GHGs are carbon dioxide (CO_2), methane, and nitrous oxide. GHGs are non-toxic and non-hazardous at normal ambient concentrations, and there are no applicable ambient air quality standards or emission limits for GHGs under the CAA. The primary greenhouse gas emitted by electric utilities is CO_2, produced by the combustion of coal, natural gas, and other fossil fuels. Under the 2019 IRP, TVA CO_2 emissions (measured by both tons emitted and by the emissions rate) resulting from the power generated by TVA and from non-TVA facilities marketed by TVA are anticipated to continue to decline (TVA 2019a). This decline is due to reduced coal-fired generation, increased natural gas-fired generation, and increased renewable generation.

3.4.2 Environmental Consequences

This section describes the potential impacts to climate and air quality should the No Action Alternative or either action alternative be implemented.

3.4.2.1 No Action Alternative

Under the No Action Alternative, TVA would continue to implement the LTP agreements and current trends in air quality would continue. Emissions of criteria air pollutants and GHGs, from stationary emission sources, especially in the power sector, and from mobile sources, would continue to decline in the TVA region. These declines are expected due to market forces (e.g., low prices for natural gas), demands for more renewable energy, and the effects of USEPA requirements for new mobile source engine emissions and cleaner fuels. Trends in future emissions from the TVA power system are described in the 2019 IRP EIS (TVA 2019a).

3.4.2.2 Alternative A

Under Alternative A, TVA would establish Flexibility Agreements with Valley Partners to provide power supply flexibility. Any generating facilities developed by LPCs under Alternative A would be required to comply with the applicable regulations of the Clean Air Act. Construction activities would result in emissions of air pollutants from the operation of fossil-fueled construction equipment. These would be short-term and would not result in adverse impacts to air quality. Construction activities could also result in the emission of particulates by site preparation activities. These would be localized in the project areas and minimized by the use of applicable best management practices. Natural gas-fired generation emits NOx, CO, and CO_2. Emissions of SO_2 and mercury are negligible. The extraction and transport of natural gas also emits methane, a potent GHG (TVA 2019a).

3.4.2.2.1 Deployment Scenario 1: 100 Percent Solar Generation

Solar generation does not produce emissions of air pollutants, including GHGs, and the solar generation installed under this and the other deployment scenarios would mostly offset natural gas-fired generation. In comparison to the ongoing emissions decline in the region as described for the No Action Alternative, Deployment Scenario 1 is expected to result in a slightly faster emissions decline in the region. The effect would be modest, given the replacement solar power

would displace five percent or less of TVA's existing generating capacity and, due to the low capacity factor of solar generation, a smaller proportion of TVA generation. Because most of the displaced TVA generation would be natural gas-fired, Deployment Scenario 1 would result in small reductions in emissions of NOx and CO_2, air pollutants emitted by natural gas-fired generation. The reductions in air pollutants, including CO_2, would be within the range predicted for the 2019 IRP under the Current Outlook Scenario (TVA 2019a). Overall impacts to air resources would be small and beneficial.

3.4.2.2.2 Deployment Scenario 2: 90 Percent Solar and 10 Percent Natural Gas-Fired Generation

The impacts to air resources under this deployment scenario would be similar to and slightly greater than those of Deployment Scenario 1 due to the small proportion of natural gas-fired generation. The gas generation included in Deployment Scenario 2 has relatively low emissions compared to some TVA natural gas-fired generators that it would offset, and the thermal energy processes in CHP systems further reduce emissions. Overall impacts to air resources of Deployment Scenario 2 would be small and beneficial. Emissions from the TVA power system would be in the range forecast in the 2019 IRP.

3.4.2.2.3 Deployment Scenario 3: 50 Percent Solar and 50 Percent Natural Gas-Fired Generation

With the larger proportion of natural gas-fired generation, Deployment Scenario 3 would result in greater emissions of air pollutants, including CO_2, than the other deployment scenarios. As with Deployment Scenario 2, the gas generation included in Deployment Scenario 3 has relatively low emissions compared to some TVA natural gas-fired generators that it would offset, and the thermal energy processes in CHP systems further reduce emissions. Overall impacts to air resources would be small and beneficial, and emissions from the TVA power system would be in the range forecast in the 2019 IRP.

3.4.2.3 Alternative B

Under Alternative B, the impacts to air resources would be similar to those of Alternative A, except that the total installed solar capacity could increase to a maximum of approximately 2,000 MW under Deployment Scenario 1, 1,800 MW under Deployment Scenario 2, and 1,000 MW under Deployment Scenario 3. Under all three deployment scenarios, the increased solar generating capacity would offset a larger amount of natural gas-fired generation that would have been provided by TVA that under Alternative A. As with Alternative A, overall impacts to air resources under Alternative B would be small and beneficial, and emissions from the TVA power system would be in the range forecast in the 2019 IRP.

3.5 Water Resources

This section presents an overview of existing water resources in the TVA PSA, as described in the 2019 IRP EIS, and the potential impacts on these water resources that would be associated with each alternative. Components of water resources that are analyzed include groundwater, surface water, wetlands, and floodplains.

3.5.1 Affected Environment

The quality of the region's surface water and groundwater is critical to the protection of human health and aquatic life. Major watersheds in the TVA region include the entire Tennessee River basin, most of the Cumberland River basin, and portions of the lower Ohio, lower Mississippi, Green, Pearl, Mobile-Tombigbee, and Alabama River basins. As described in detail in the 2019 IRP EIS, these water resources provide habitat for aquatic life, including ecologically and recreationally important invertebrate and fish communities; recreational opportunities; domestic

and industrial water supplies; navigation; and other benefits (TVA 2019a). Wastewater discharges from cities or industries and runoff from nonpoint source activities such as construction, agriculture, mining, and air deposition can potentially degrade water quality.

Pollution involves the presence or introduction of a substance or object into water resources that may harm the water resource and impact its beneficial uses, such as swimming or aquatic life. Every two years, states are required to update and submit a report to the USEPA under Section 303(d) of the Clean Water Act (CWA). This report identifies the impaired lakes and streams that are not complying with water quality criteria and, consequently, are not suitable for their designated use(s). Thus, each state's 303(d) report provides an updated overview of assessed water quality in each state.

Sources of degraded water quality may include:

- Wastewater discharges from municipal sewage treatment systems, industrial facilities, concentrated animal feeding operations, and other sources;
- Runoff discharges from agriculture, forest management activities, urban uses, and mine lands, which transport sediment and other pollutants into streams and reservoirs. Runoff from commercial and industrial facilities and some construction sites is regulated through state National Pollutant Discharge Elimination System (NPDES) stormwater permitting programs. Sources not regulated through the NPDES program are referred to as "nonpoint source" runoff;
- Cooling systems, such as those used by electrical generating plants and other industrial facilities to withdraw water from streams or reservoirs, use it to cool facility operations, and then discharge the above ambient water into streams and reservoirs. Impacts can result from temperature changes, the trapping of organisms against intake screens, or sucking organisms through the facility cooling system. These water intakes and discharges are controlled through state-issued NPDES permits;
- Air pollution in the form of airborne pollutants such as SO_2, mercury, and NO_x being spread through rainfall and deposition;
- Man-made impoundments such as dams can cause low dissolved oxygen and other water quality issues in head and tail waters; and
- Contamination of the bottom sediments of a stream from point or non-point source pollution can cause bioaccumulation of contaminant in fish tissue, which could lead to fish consumption advisories and compromise of species health, especially of bottom feeding/dwelling species.

Additional regulatory protections for water quality and the mechanisms of how power generation can affect water quality and aquatic life are discussed in detail in the 2019 IRP EIS (TVA 2019a).

Groundwater refers to water located beneath the surface in rock formations known as aquifers. Eight major aquifers occur in the TVA region. Approximately half of the region has limited groundwater availability because of natural geo-hydrological conditions. More than 64 percent of the region's residents rely totally, or in part, on groundwater for drinking water. More than 1.7 million residents (22 percent) in the region maintain individual household groundwater systems, usually a well. All areas in the Tennessee Valley region can generally supply enough water for at least domestic needs. For the most part, the groundwater quality is adequate to support existing water supply uses even though some minimal treatment, such as filtration and chlorination, is sometimes required. Generating facilities involving combined cycle combustion

turbines often make use of groundwater for either cooling or reinjection of heated water (TVA 2019a).

Wetlands are areas that are inundated or saturated by water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas. Wetlands occur across the TVA region and are most extensive in the south and west where they comprise 5 percent or more of the landscape (U.S. Geological Survey 2016). Wetlands in the TVA region consist of two main systems: palustrine wetlands such as marshes, swamps and bottomland forests dominated by trees, shrubs, and persistent emergent vegetation, and lacustrine wetlands associated with lakes such as aquatic bed wetlands (Cowardin et al. 1979). Riverine wetlands associated with moving water within a stream channel are also present but relatively uncommon. Almost 200,000 acres of wetlands are associated with the TVA reservoir system, where they are more prevalent on mainstem reservoirs and tailwaters than tributary reservoirs and tailwaters (TVA 2004). Almost half of this area is forested wetlands; other types include aquatic beds and flats, ponds, scrub/shrub wetlands and emergent wetlands (TVA 2019a).

Floodplains are the relatively level land areas along a stream or river that are subjected to periodic flooding. The area subject to a one-percent chance of flooding in any given year is normally called the 100-year floodplain. The area subject to a 0.2-percent-chance of flooding in any given year is normally called the 500-year floodplain. It is necessary to evaluate development in the 100-year floodplain to ensure that the project is consistent with the requirements of EO 11988 – Floodplain Management. In the TVA region, floodplains are associated with reservoirs, streams, ponds, and sinkholes. Power generation facilities of any type, as well as electric transmission lines, could be proposed by TVA or outside entities anywhere in the TVA region (TVA 2019a).

3.5.2 Environmental Consequences

This section describes the potential impacts to water resources should the No Action Alternative or either action alternative be implemented.

3.5.2.1 No Action Alternative

Under the No Action Alternative, TVA would continue to implement the LTP agreements and the current condition of water quality in the TVA PSA would be unaffected.

3.5.2.2 Alternative A

Under Alternative A, TVA would establish Flexibility Agreements with Valley Partners to provide power supply flexibility. Potential impacts to water resources from generating capacity installed by LPCs are regulated by the Clean Water Act, including the NPDES permitting system, which regulates discharges of water pollutants, and CWA Section 404, which regulates the discharge of dredge and fill material in streams and wetlands. The seven states in the TVA PSA have also enacted laws regulating water quality and implementing the CWA. As part of this implementation, the states classify water bodies according to their uses and establish water quality criteria specific to these uses. Each state has also issued an antidegradation statement containing specific conditions for regulated actions and designed to maintain and protect current uses and water quality conditions. Some TVA-region states provide additional protections for streams and wetlands. Developments in floodplains must be regulated for communities that participate in the Federal Emergency Management Agency National Flood Insurance Program (NFIP), and a large proportion of communities in the TVA PSA participate in this program. In addition, development across, along, or in the Tennessee River and its tributaries is also subject

to the requirements of Section 26a of the TVA Act. Activities proposed within Section 26a jurisdiction and/or in places where TVA owns property or property rights would be subject to review under EO 11988 in connection with TVA's Section 26a or land use approvals, or both.

3.5.2.2.1 Deployment Scenario 1: 100 Percent Solar Generation

Solar generation in the TVA region typically does not require water to operate and does not discharge wastewater (TVA 2019a). Under this scenario, the solar generation would most likely displace TVA natural gas-fired generation as well as, during the latter years of the planning period, some TVA solar generation. The displaced natural gas-fired generation would include generation from combined cycle units, which require about 250 gallons/megawatt-hour (MWh) of water to operate (TVA 2019a) and combustion turbines, which require much smaller quantities of water to operate. Most of this water is for cooling and is evaporated. Any system-wide change in water usage and wastewater discharges would be negligible.

Generally, sites within or containing wetland areas tend to be unsuitable for construction of solar projects due to the presence of water. Any wetland impacts would be mitigated under regulations implementing Section 404 of the CWA and applicable state regulations. Generally, the development of ground-mounted or rooftop-mounted solar facilities can result in impacts to floodplains. If a solar facility is located within the 100-year floodplain, then PV panels and all electrical equipment would necessarily be located at least 1 foot above the 100-year flood elevation at that location, and the project would have to comply with the requirements of the NFIP consistent with the local community's floodplain regulations. If the project is located along a TVA reservoir, more stringent flood risk requirements may apply. If the proposed solar facility involves mounting the equipment on an existing rooftop, an evaluation of flooding impacts to the building would be considered. Although the PV equipment would be located on top of a building, at an elevation that would likely be well above the 100-year flood elevation, the building itself could be subject to flood damage. Typically, the equipment at proposed solar sites would be located at elevations above the 100-year floodplain and PV panels and all electrical equipment would be elevated consistent with the requirements of the NFIP. Compliance with applicable laws and regulations would minimize many of the potential impacts to wetlands and floodplains.

3.5.2.2.2 Deployment Scenario 2: 90 Percent Solar and 10 Percent Natural Gas-Fired Generation

Under this scenario, the effects of the solar generation on water resources would be similar to those of Deployment Scenario 1. Operation of the relatively small proportion (total of 80 MW) of natural gas-fired facilities would require small quantities of water, primarily for cooling purposes and would produce little to no wastewater. The Wartsila 18V50SG RICE generator set, for example, requires about 0.05 gallons/MWh. RICE generator sets used in CHP systems would have similar water requirements, and turbine generators used in CHP systems often require no water to operate. The thermal energy side of a CHP system uses water to produce steam or for other purposes. This often does not result in a net increase in water consumption or wastewater discharge by the host facility. Because the natural gas-fired generation developed under this scenario would primarily displace TVA natural gas-fired generation, overall effects on water resources would be negligible. As with Deployment Scenario 1, compliance with applicable laws and regulations would minimize many of the potential impacts to water resources.

3.5.2.2.3 Deployment Scenario 3: 50 Percent Solar and 50 Percent Natural Gas-Fired Generation

Compared to the other deployment scenarios, this scenario would have the greatest impact on water resources due to the use of water by the natural gas-fired stand-alone RICE generator sets and CHP systems. The water use rates by these systems is low compared to the water use

by the TVA natural gas-fired generation that they would displace, resulting in a small net decrease in water use by the TVA power system. Changes in wastewater discharges would be negligible. As with the other deployment scenarios, compliance with applicable laws and regulations would minimize many of the potential impacts to water resources.

3.5.2.3 Alternative B

Under Alternative B, the impacts to water resources would be similar to those of Alternative A except the total installed capacity could increase to a maximum of approximately 2,000 MW under Deployment Scenario 1. Under all three deployment scenarios, the increased solar generating capacity would offset a larger amount of natural gas-fired generation that would have been provided by TVA than under Alternative A. As with Alternative A, any system-wide change in water usage and wastewater discharges under Alternative B would be negligible.

3.6 Land Resources

This section describes an overview of existing land resources in the TVA PSA, as described in the 2019 IRP and associated EIS, and potential impacts to land resources associated with each alternative.

3.6.1 Affected Environment

TVA's power system serves nearly 10 million people in a seven-state, 80,000-square-mile region. Major land uses in the TVA region include forestry, agriculture, and urban/suburban/industrial development (USDA 2018). Regional land use is described in detail in the 2019 IRP EIS (TVA 2019a). Of the non-federal land area, approximately 12 percent is classified as developed and 88 percent as rural (USDA 2013). About 28 percent of the rural area is classified as farmland and 60 percent is classified as forestland. Trends in recent decades show an increase in developed land, mostly through conversion of farmland. Lands in the TVA region support diverse plant and animal populations, including many economically and recreationally important species and species classified as endangered or threatened. Refer to TVA (2019a) for more detailed information.

3.6.2 Environmental Consequences

This section describes the potential impacts to land resources should the No Action Alternative or either action alternative be implemented. Several federal, state, and local laws and regulations affecting land resources are applicable to LPC generating facilities. These include the federal Endangered Species Act, which prohibits actions which would adversely affect plant and animal species listed as endangered or threatened under the act. State and local regulations protect many designated historic sites and districts, as well as cemeteries. Many communities, particularly in more urban areas, have also adopted zoning ordinances, which prescribe allowable uses of land areas within the community's jurisdiction. A large proportion of the more rural parts of the TVA PSA have no zoning restrictions.

3.6.2.1 No Action Alternative

Under the No Action Alternative, TVA would continue to implement the LTP agreements and there would be no impacts to land resources from the construction and operation of LPC generating facilities under Flexibility. Regional land use trends and development in the TVA PSA would continue as identified in the 2019 IRP EIS (TVA 2019a).

3.6.2.2 Alternative A

Under Alternative A, TVA would establish Flexibility Agreements with Valley Partners to provide power supply flexibility.

3.6.2.2.1 Deployment Scenario 1: 100 Percent Solar Generation

The construction and operation of up to 800 MW of solar generation by participating LPCs would require up to about 6,900 acres of land, assuming the arrays were all ground-mounted, single-axis tracking systems. This represents between about 12 and 20 percent of the land area, mostly for solar, required to implement the 2019 IRP under the Current Outlook Scenario (TVA 2019a) and would likely offset a portion of the forecast IRP land requirement. Other solar configurations, particularly rooftop-mounted solar, would reduce this land area.

Much of the required land area would likely be relatively flat farmland which is distributed across the TVA PSA. As described in the 2019 IRP EIS (TVA 2019a), the development of solar facilities on farmland often removes the area from agricultural production but does not result in long-term impacts that prevent its future use for farming. The availability of relatively flat land suitable for solar development, however, may be limited within the more urban territories of some of the largest LPCs.

Generally, the development of ground-mounted solar facilities can result in the clearing of forests, alteration of habitats for plants and animals, potentially including endangered and threatened species, and impacts to archaeological sites, historic areas, and scenic landscapes (TVA 2019a). Solar facilities have a low profile but, depending on the terrain and other site characteristics, can alter local scenery. Compliance with applicable laws and regulations would minimize many of these potential impacts.

3.6.2.2.2 Deployment Scenario 2: 90 Percent Solar and 10 Percent Natural Gas-Fired Generation

The solar generation in this deployment scenario would occupy up to about 6,200 acres. The potential 80 MW of natural gas-fired generation would occupy a much smaller land area than the equivalent capacity of ground-mounted solar generation. Individual gas-fired generators and CHP systems require small land areas, often less than an acre, and all CHP systems would be sited on industrial, commercial, or institutional campuses. As with Deployment Scenario 1, compliance with applicable laws and regulations would minimize many of the potential impacts to land resources. Overall impacts to land resources under this deployment scenario would likely be insignificant and within the range of those of the 2019 IRP (TVA 2019a).

3.6.2.2.3 Deployment Scenario 3: 50 Percent Solar and 50 Percent Natural Gas-Fired Generation

The solar generation in this deployment scenario would occupy up to about 3,440 acres and the gas-fired generation would occupy a much smaller land area. Individual gas-fired generators and CHP systems require small land areas, often less than an acre, and all CHP systems would be sited on industrial, commercial, or institutional campuses. This deployment scenario has the lowest land requirements and potentially the lowest likelihood of adverse impacts to land resources. As with the other deployment scenarios, compliance with applicable laws and regulations would minimize many of the potential impacts to land resources. Overall impacts to land resources under this deployment scenario would likely be insignificant and within the range of those of the 2019 IRP (TVA 2019a).

3.6.2.3 Alternative B

Under Alternative B, TVA would establish Flexibility Agreements with Valley Partners to provide power supply flexibility.

3.6.2.3.1 Deployment Scenario 1: 100 Percent Solar Generation

The construction and operation of up to 2,000 MW of solar generation by participating LPCs would require up to about 17,250 acres of land, assuming the arrays were all ground-mounted, single-axis tracking systems. This represents between about 30 and 50 percent of the land area, mostly for solar, required to implement the 2019 IRP under the Current Outlook Scenario (TVA 2019a) and would likely offset a portion of the forecast IRP land requirement. Other solar configurations, particularly rooftop-mounted solar, would reduce this land area. The land area required for the largest LPCs to develop 100 percent solar would be greater than 250 acres, with a couple requiring approximately 600 and 700 acres. These LPCs could be constrained by limited availability of developable acreage within their territories.

Much of the required land area would likely be relatively flat farmland which is distributed across the TVA PSA. As described in the 2019 IRP EIS (TVA 2019a), the development of solar facilities on farmland often removes the area from agricultural production but does not result in long-term impacts that prevent its future use for farming. The availability of relatively flat land suitable for solar development, however, may be limited within the more urban territories of some of the largest LPCs.

Generally, the development of ground-mounted solar facilities can result in the clearing of forests, alteration of habitats for plants and animals, potentially including endangered and threatened species, and impacts to archaeological sites and historic areas, and scenic landscapes (TVA 2019a). Solar facilities have a low profile but, depending on the terrain and other site characteristics, can alter local scenery. Compliance with applicable laws and regulations would minimize many of these potential impacts.

3.6.2.3.2 Deployment Scenario 2: 90 Percent Solar and 10 Percent Natural Gas-Fired Generation

The solar generation in this deployment scenario would occupy up to about 15,525 acres. The potential 200 MW of natural gas-fired generation would occupy a much smaller land area than the equivalent capacity of ground-mounted solar generation. Individual gas-fired generators and CHP systems require small land areas, often less than an acre, and all CHP systems would be sited on industrial, commercial, or institutional campuses. As with Deployment Scenario 1, compliance with applicable laws and regulations would minimize many of the potential impacts to land resources. Overall impacts to land resources under this deployment scenario would likely be insignificant and within the range of those of the 2019 IRP (TVA 2019a).

3.6.2.3.3 Deployment Scenario 3: 50 Percent Solar and 50 Percent Natural Gas-Fired Generation

The solar generation in this deployment scenario would occupy up to about 8,625 acres and the gas-fired generation would occupy a much smaller land area. Individual gas-fired generators and CHP systems require small land areas, often less than an acre, and all CHP systems would be sited on industrial, commercial, or institutional campuses. This deployment scenario has the lowest land requirements and potentially the lowest likelihood of adverse impacts to land resources. As with the other deployment scenarios, compliance with applicable laws and regulations would minimize many of the potential impacts to land resources. Overall impacts to land resources under this deployment scenario would likely be insignificant and within the range of those of the 2019 IRP (TVA 2019a).

3.7 Waste Generation

This section describes an overview of existing waste management within the TVA PSA, as described in the 2019 IRP EIS, and the potential impacts to waste management that would be

associated with each alternative. Components of waste management that are analyzed include solid and hazardous waste and materials.

3.7.1 Affected Environment

3.7.1.1 Residential, Commercial, and Industrial Wastes

Residential and commercial wastes are usually generated in many diffusely located areas and handled at municipal solid waste landfills. Most municipalities and counties currently engage in long-range planning processes to ensure that adequate capacity is provided for solid wastes generated within their jurisdictions. Solid waste reduction and recycling is an important emphasis in most of these plans. For example, in 2017, Tennessee businesses, industries, citizens, and others disposed of 17,045,462 tons of solid waste. Of this amount, 7,373,749 tons went to Class 1 landfills and 161,897 tons were recycled, reused, or diverted to other facilities (TDEC 2018).

Current legislative and regulatory programs encourage and/or mandate the reduction, recycling, and proper disposal of industrial solid and hazardous wastes. The states within the TVA PSA have state-administered Resource Conservation and Recovery Act (RCRA) equivalent programs, which emphasize waste reduction, recycling, and proper handling and disposal of solid and hazardous wastes. Industries benefit both financially and from a public relations standpoint by engaging in waste reduction and recycling opportunities in the same way that TVA benefits from its marketing and utilization of coal combustion residuals (CCR) that are a by-product of coal-based generation. It is, therefore, likely that industrial solid and hazardous waste generation and disposal will continue to decline in the future.

Disposal of solar equipment at the end of its useful life could also result in solid and hazardous waste. Solar panels can be recycled, but recycling is currently not widely available in the U.S. (Marsh 2018). However, options for recycling solar panels are expected to increase as the overall market expands and currently deployed panels near the end of their expected lives. If recycling is not available, solar panels often end up in landfills. Recycling of typical solar PV panels lacked strong economic rationale from 2010 to 2015 (Tao and Yu 2015).

The impacts of solar equipment disposal, especially improper disposal, have been widely noted in various studies (e.g., Aman et al. 2015; Paiano 2015). A detailed report on global waste from solar systems estimated that the U.S. will generate a cumulative 7.5 million to 10 million tons of solar equipment waste by 2050, making the U.S. the second greatest producer of solar waste after China. That report also estimated that by 2050, global annual waste from solar panels alone could exceed 10 percent of the total global electronic waste produced in recent years (Weckend et al. 2016).

Additionally, only the European Union has enacted waste regulations specific to solar panels. In other countries, including the U.S., solar panels are typically treated as general waste or industrial waste. The most common type of solar panels produced globally are based on crystalline silicon technology. These panels are composed primarily of glass, aluminum, silicon, polymer, and copper (Weckend et al. 2016).

An alternative solar panel technology that is currently less common is termed thin-film cadmium telluride, which is composed primarily of glass and polymer (Weckend et al. 2016). In addition, these panels contain small amounts of cadmium compounds, which are potentially harmful to human health if leached from landfills. The potential human health burden from these panels in landfills was assessed, and it was determined that they did not likely present a material risk given current levels of solar adoption (Cyrs et al. 2014).

Additional sources of waste related to solar systems include panel mounting and racking systems, which are typically composed of aluminum and steel. A smaller total quantity of waste may also be produced from end-of-life electrical inverters and stationary batteries.

3.7.1.2 TVA-Generated Wastes

Types of wastes typically produced by construction activities, whether by TVA or others, include vegetation, demolition debris, oily debris, packing materials, scrap lumber, and domestic wastes or garbage. Non-hazardous wastes (excluding CCR) typically produced by common operation of TVA facilities include sludge and demineralizers from water treatment plant operations, personal protective equipment, oils and lubricants, spent resins, desiccants, batteries, and domestic waste. In 2016, TVA facilities produced approximately 23,000 tons of non-hazardous solid waste per year; this quantity decreased to approximately 18,750 tons in 2017 (TVA 2019a).

TVA facilities include large, small, and very small quantity generators (previously conditionally exempt generators) of hazardous waste. Hazardous non-radiological wastes typically produced by common TVA facility operations include paint and paint solvents, paint thinners, discarded out-of-date chemicals, parts washer liquids, sand blast grit, chemical waste from cleaning operations, and broken fluorescent bulbs. Routine operations between 2015 and 2017 created an average of 9.49 tons of hazardous waste. In 2017, approximately 27.4 tons of universal waste was generated and recycled by TVA (TVA 2019a). TVA's hazardous wastes, those requiring special handling under the Toxic Substances Control Act (TSCA), and universal waste are generally shipped to Waste Management's Emelle, Alabama facility for disposal (TVA 2019a).

Coal combustion solid wastes or residues (i.e. CCRs) include fly ash, bottom ash, boiler slag, char spent bed material, and sludge from operation of wet flue gas desulfurization systems. In the past, the USEPA determined that CCRs are not hazardous, and in April 2015 the USEPA decided to continue to regulate them as non-hazardous, solid waste. In 2015, TVA produced approximately 3.9 million tons of CCRs, of which 33.6 percent was utilized or marketed (TVA 2016). Annually, CCR production at TVA's coal-fired plants fluctuates due to a variety of factors including: plant planned and forced maintenance outages, load swings, plant dispatch (the process by which plants are directed to increase or decrease power generation based on the cost of production at each plant (generally the larger, more efficient units run more and the smaller, less efficient units run less)), and variation in fuel supplies. Additionally, recent decisions to retire coal-fired generation further reduce the amount of CCRs generated by TVA at its plants. The amount of CCRs that are disposed of is also reduced through marketing and utilization of these by-products in a number of commercial applications including the use of fly ash in concrete products, bottom ash as aggregate in cement block manufacturing, boiler slag for roofing granules and industrial abrasives, and scrubber gypsum in gypsum wallboard and cement manufacturing.

3.7.2 Environmental Consequences

This section describes the potential impacts to waste management should the No Action Alternative or either action alternative be implemented. Waste management is subject to several federal laws and associated regulations, including the Comprehensive Environmental Response, Compensation, and Liability Act, the Resource Conservation and Recovery Act, TSCA, and various state laws and regulation.

3.7.2.1 No Action Alternative

Under the No Action Alternative, TVA would continue to implement the LTP agreements and current trends in waste production and reduction, as identified in the example for Tennessee above and in the 2019 IRP, would continue in the TVA PSA.

3.7.2.2 Alternative A

Under Alternative A, TVA would establish Flexibility Agreements with Valley Partners to provide power supply flexibility. The construction of LPC generating facilities under all of the deployment scenarios produces various non-hazardous solid wastes, including relatively large quantities of packaging materials for solar facilities. Assuming an average of 280 cubic yards per MW of solar capacity, generation of up to 224,000 cubic yards of packaging materials could occur under Deployment Scenario 1, up to 201,600 cubic yards under Deployment Scenario 2, and up to 112,000 cubic yards under Deployment Scenario 3. These wastes would be recycled where feasible, and remaining wastes would be managed in accordance with applicable laws and regulations. Any hazardous wastes generated during construction would also be managed in accordance with applicable laws and regulations.

Wastes would be generated during the operation of the solar and natural gas-fired generating facilities, including lubricants, hydraulic fluids, and replacement parts, including batteries. These wastes would be recycled where feasible and otherwise managed in accordance with applicable laws and regulations.

The LPC generation would largely offset TVA natural gas-fired generation, which produces relatively small quantities of wastes (IRP EIS Section 4.7, TVA 2019a). The quantities of CCR produced by TVA coal-fired generation are unlikely to be affected. Overall quantities of wastes from the TVA power system, and their associated impacts, would be similar under all of the Alternative A deployment scenarios.

3.7.2.3 Alternative B

Under Alternative B, the impacts to waste generation would be similar to those of Alternative A, except that the total installed capacity could increase to a maximum of approximately 2,000 MW under Deployment Scenario 1. Under all three deployment scenarios, the increased solar generating capacity would produce increased quantities of waste during construction and operation. Assuming an average of 280 cubic yards per MW of solar capacity, generation of up to 560,000 cubic yards of packaging materials could occur under Deployment Scenario 1, up to 504,000 cubic yards under Deployment Scenario 2, and up to 280,000 cubic yards under Deployment Scenario 3. As with Alternative A, no adverse impacts to waste management are anticipated with the use of best management practices under Alternative B.

3.8 Cumulative Impacts

Cumulative impacts are defined as the effects of Alternatives A and B when considered together with other past, present, and reasonably foreseeable future actions. This section addresses the cumulative impacts of the alternatives and any reasonably foreseeable actions in the vicinity.

TVA utilizes its IRP process to consider the many cumulative market and social forces that programs addressing renewable energy resources, expansion of DER, energy efficiency, and other relevant inputs, have on TVA's energy generation. TVA also utilizes its IRP process to provide direction on how to best meet future electricity demand. The 2019 IRP provides an important discussion regarding past, present, and reasonably foreseeable activities that influence energy use, and the associated EIS describes cumulative impacts from combining different scenarios and strategies (TVA 2019a).

Other related TVA activities that may cumulatively affect resources of concern are the Green Power Providers, Green Power Switch, and Green Invest programs; economic development efforts; rate changes; energy efficiency programs for residences, businesses, and industries (e.g., TVA EnergyRight programs); and LTP agreements.

The Green Power Providers program is an EUC generation dual-metering program that began in 2003 as the Generation Partners Pilot Program. It was developed in an effort to provide LPCs the opportunity to support environmental stewardship while responding to the growing consumer interest in generating renewable power. It also provided customers with an alternative to net metering that was compatible with the existing power contracts between TVA and LPCs. Participation in the program is optional for LPCs. Through the program, participating LPCs' residential and commercial EUCs with renewable solar, wind, low-impact hydro, or biomass generating facilities, subject to capacity limits, sell all of the generation to TVA for the term of their 20-year Participation Agreement for a fixed kilowatt-hour rate (TVA 2019b). The Green Power Providers program was closed to new applicants in early 2020. Because the generation from this program represents such a small portion of overall generation in the TVA PSA, the program results in minimal effects on the environment (TVA 2019b).

The Green Power Switch program allows those interested in supporting renewable energy to purchase blocks of renewable energy backed by renewable energy certificates and therefore increase the percentage of electricity used that is generated by renewable resources. This program is available to all LPCs and their customers, and will become more accessible in 2020 as the block size is increased and price is decreased.

TVA's Green Invest program also promotes DER development in the Tennessee Valley. The program is intended to serve a wide range of customers seeking access to large-scale renewable energy. The Green Invest framework is modeled on TVA's work that began in 2018 to meet the renewable energy needs of Facebook and Google data centers locating in the region. The program is now available to customers across TVA's service territory including universities, manufacturing, and LPCs. Green Invest meets the growing demand for green power through agreements to build new, utility-scale renewable energy installations through a competitive bid process. While available to all LPCs, Valley Partners generally receive commercial terms reflective of the long-term commitment they have made to the Valley, resulting in more favorable solutions for their customers. Since 2019, several Green Invest projects have been initiated with 662 MW of renewable generation planned. All projects contracted in 2019 are solar facilities and would have similar impacts as those described in the 2019 IRP EIS and in this EA.

In 2018, TVA implemented a rate change that included establishing a grid access charge[2]. In reviewing the rate change proposal, TVA found that the grid access charge may marginally affect the incentive for end users to invest in alternative energy sources. TVA estimated, for instance, that the payback period of a typical rooftop solar investment would increase from approximately 15 to 16 years. Other than minor socioeconomic impacts, TVA found that the 2018 rate change may result in negligible changes in energy sales that are not substantial enough to discern impacts to environmental resources.

The LTP agreements strengthen the contractual relationships between LPCs and TVA and secure the benefits of the public power model for decades to come. Key elements of the LTP

[2] The Grid Access Charge is a 0.5 cent/kWh wholesale charge based on an LPC's prior five years of energy sales. It was offset by a 0.5 cent/kWh reduction in ongoing energy charges.

agreements are long-term commitments, a partnership credit, rate adjustment protection, input to long-term planning, and power supply flexibility. TVA does not foresee that the LTP agreements would have an effect, significant or otherwise, on TVA's generation portfolio mix.

Climate change resulting from GHG emissions is a cumulative impact. TVA assessed GHG emissions, under the worst-case scenario, Deployment Scenario 3 under Alternative A and B, in the air resources section (Section 3.4). As stated in Section 3.4, impacts to air resources would be small and beneficial and there would be no impacts to climate change; GHG emissions from the TVA power system would be in the range forecast in the 2019 IRP. The analysis of the direct and indirect effects for GHG emissions adequately addresses the cumulative impacts for climate change because the potential effects of GHG emissions are inherently a global cumulative effect.

Thus, the overall cumulative impacts of implementing Alternatives A and B when considered together with other past, present, and reasonably foreseeable future actions are expected to be minimal and within the bounds of the impacts described in the 2019 IRP EIS (TVA 2019a).

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CHAPTER 5 – REFERENCES

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Appendix A – LPC Power Supply Flexibility Capacity Estimates

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Appendix A – LPC Power Supply Flexibility Capacity Estimates

The amounts presented in this table represent five percent of the average total hourly energy sales for the period October 1, 2014 through September 30, 2019, expressed in megawatts for each local power company served by TVA. Although all local power companies served by TVA are included in the table, the amounts represent allocated power supply flexibility capacity only for local power companies that have executed a Long-Term Partnership Agreement with TVA.

LOCAL POWER COMPANY	FLEXIBILITY IN MW
MEMPHIS LIGHT GAS & WATER DIVISION	81
NASHVILLE ELECTRIC SERVICE	70
MIDDLE TENNESSEE ELECTRIC MEMBERSHIP CORP	35
ELECTRIC POWER BOARD OF CHATTANOOGA	34
KNOXVILLE UTILITIES BOARD	32
HUNTSVILLE UTILITIES	31
CUMBERLAND ELECTRIC MEMBERSHIP CORP	16
NORTH GEORGIA ELECTRIC MEMBERSHIP CORP	14
VOLUNTEER ENERGY COOPERATIVE	14
WARREN RURAL ELECTRIC COOPERATIVE CORP	12
DUCK RIVER ELECTRIC MEMBERSHIP CORP	11
JOHNSON CITY ENERGY AUTHORITY	11
JACKSON ENERGY AUTHORITY	10
JOE WHEELER ELECTRIC MEMBERSHIP CORP	10
LENOIR CITY UTILITIES BOARD	10
MURFREESBORO ELECTRIC DEPARTMENT	10
CLARKSVILLE DEPARTMENT OF ELECTRICITY	9
SEVIER COUNTY ELECTRIC SYSTEM	9
ATHENS ELECTRIC DEPARTMENT	7
CITY OF FLORENCE UTILITIES	7
DECATUR UTILITIES	7
GREENEVILLE ENERGY AUTHORITY	7
MERIWETHER LEWIS ELECTRIC COOPERATIVE	7
PENNYRILE RURAL ELECTRIC COOPERATIVE CORP	7
TOMBIGBEE ELECTRIC POWER ASSOCIATION	7
TRI-COUNTY ELECTRIC MEMBERSHIP CORP	7
4-COUNTY ELECTRIC POWER ASSOCIATION	6
APPALACHIAN ELECTRIC COOPERATIVE	6
CLEVELAND UTILITIES	6
CULLMAN ELECTRIC COOPERATIVE	6
NORTHCENTRAL ELECTRIC COOPERATIVE	6
SOUTHWEST TENNESSEE ELECTRIC MEMBERSHIP CORP	6
UPPER CUMBERLAND ELECTRIC MEMBERSHIP CORP	6
BOWLING GREEN MUNICIPAL UTILITIES	5
BRISTOL TENNESSEE ESSENTIAL SERVICES	5

LOCAL POWER COMPANY	FLEXIBILITY IN MW
CENTRAL ELECTRIC POWER ASSOCIATION	5
CITY OF MARYVILLE ELECTRIC DEPARTMENT	5
CLINTON UTILITIES BOARD	5
DICKSON ELECTRIC DEPARTMENT	5
GALLATIN DEPARTMENT OF ELECTRICITY	5
GIBSON ELECTRIC MEMBERSHIP CORP	5
HOLSTON ELECTRIC COOPERATIVE	5
MORRISTOWN UTILITY COMMISSION	5
SEQUACHEE VALLEY ELECTRIC COOPERATIVE	5
ALCORN COUNTY ELECTRIC POWER ASSOCIATION	4
ATHENS UTILITIES BOARD	4
BLUE RIDGE MOUNTAIN ELECTRIC MEMBERSHIP CORP	4
CANEY FORK ELECTRIC COOPERATIVE	4
CITY OF ALCOA	4
CITY OF TUPELO LIGHT & WATER	4
COLUMBIA POWER & WATER SYSTEMS	4
FORT LOUDOUN ELECTRIC COOPERATIVE	4
LOUDON UTILITIES	4
MOUNTAIN ELECTRIC COOPERATIVE	4
NORTH EAST MISSISSIPPI ELECTRIC POWER ASSOCIATION	4
SAND MOUNTAIN ELECTRIC COOPERATIVE	4
SHEFFIELD UTILITIES	4
TALLAHATCHIE VALLEY ELECTRIC POWER ASSOCIATION	4
WEST KENTUCKY RURAL ELECTRIC COOPERATIVE CORP	4
ALBERTVILLE MUNICIPAL UTILITIES BOARD	3
BVU AUTHORITY	3
CARROLL COUNTY ELECTRIC DEPARTMENT	3
CHEROKEE ELECTRIC COOPERATIVE	3
CHICKASAW ELECTRIC COOPERATIVE	3
COOKEVILLE ELECTRIC DEPARTMENT	3
ELIZABETHTON ELECTRIC SYSTEM	3
FAYETTEVILLE PUBLIC UTILITIES	3
LAWRENCEBURG UTILITY SYSTEMS	3
LEXINGTON ELECTRIC SYSTEM	3
MARSHALL-DEKALB ELECTRIC COOPERATIVE	3
NEWPORT UTILITIES BOARD	3
OAK RIDGE ELECTRIC DEPARTMENT	3
PARIS BOARD OF PUBLIC UTILITIES	3
PONTOTOC ELECTRIC POWER ASSOCIATION	3
POWELL VALLEY ELECTRIC COOPERATIVE	3
PULASKI ELECTRIC SYSTEM	3
STARKVILLE UTILITIES	3
WEAKLEY COUNTY MUNICIPAL ELECTRIC SYSTEM	3

LOCAL POWER COMPANY	FLEXIBILITY IN MW
ARAB ELECTRIC COOPERATIVE INC	2
BESSEMER ELECTRIC SERVICE	2
CITY OF DAYTON ELECTRIC DEPARTMENT	2
COLUMBUS LIGHT & WATER DEPARTMENT	2
CULLMAN POWER BOARD	2
DYERSBURG ELECTRIC SYSTEM	2
ETOWAH UTILITIES	2
FORT PAYNE IMPROVEMENT AUTHORITY	2
FRANKLIN ELECTRIC COOPERATIVE	2
GLASGOW ELECTRIC PLANT BOARD	2
HOPKINSVILLE ELECTRIC SYSTEM	2
LAFOLLETTE UTILITIES BOARD	2
LEWISBURG ELECTRIC SYSTEM	2
MURRAY ELECTRIC SYSTEM	2
MUSCLE SHOALS ELECTRIC BOARD	2
NATCHEZ TRACE ELECTRIC POWER ASSOCIATION	2
NEW ALBANY LIGHT GAS & WATER	2
NORTH ALABAMA ELECTRIC COOPERATIVE	2
PICKWICK ELECTRIC COOPERATIVE	2
PLATEAU ELECTRIC COOPERATIVE	2
PRENTISS COUNTY ELECTRIC POWER ASSOCIATION	2
ROCKWOOD ELECTRIC UTILITY	2
SCOTTSBORO ELECTRIC POWER BOARD	2
SHELBYVILLE POWER SYSTEM	2
SPRINGFIELD DEPARTMENT OF ELECTRICITY	2
TENNESSEE VALLEY ELECTRIC COOPERATIVE	2
TIPPAH ELECTRIC POWER ASSOCIATION	2
TISHOMINGO COUNTY ELECTRIC POWER ASSOCIATION	2
TRI-STATE ELECTRIC MEMBERSHIP CORP	2
TULLAHOMA UTILITIES AUTHORITY	2
UNION CITY ENERGY AUTHORITY	2
ABERDEEN ELECTRIC DEPARTMENT	1
AMORY WATER & ELECTRIC	1
BENTON COUNTY ELECTRIC SYSTEM	1
BENTON ELECTRIC SYSTEM	1
BOLIVAR ENERGY AUTHORITY	1
BROWNSVILLE ENERGY AUTHORITY	1
CHICKAMAUGA ELECTRIC SYSTEM	1
CITY OF MACON ELECTRIC DEPARTMENT	1
CITY OF OKOLONA ELECTRIC DEPARTMENT	1
CITY OF WATER VALLEY ELECTRIC DEPARTMENT	1
CITY OF WEST POINT ELECTRIC SYSTEM	1
COURTLAND ELECTRIC DEPARTMENT	1

LOCAL POWER COMPANY	FLEXIBILITY IN MW
COVINGTON ELECTRIC SYSTEM	1
EAST MISSISSIPPI ELECTRIC POWER ASSOCIATION	1
ERWIN ENERGY AUTHORITY	1
FORKED DEER ELECTRIC COOPERATIVE	1
FRANKLIN ELECTRIC PLANT BOARD	1
FULTON ELECTRIC SYSTEM	1
GUNTERSVILLE ELECTRIC BOARD	1
HARRIMAN UTILITY BOARD	1
HARTSELLE UTILITIES	1
HICKMAN ELECTRIC PLANT BOARD	1
HOLLY SPRINGS ELECTRIC DEPARTMENT	1
HUMBOLDT UTILITIES	1
JELLICO UTILITIES AUTHORITY	1
LOUISVILLE UTILITIES	1
MAYFIELD ELECTRIC & WATER SYSTEM	1
MCMINNVILLE ELECTRIC SYSTEM	1
MILAN DEPARTMENT OF PUBLIC UTILITIES	1
MONROE COUNTY ELECTRIC POWER ASSOCIATION	1
MOUNT PLEASANT POWER SYSTEM	1
MURPHY POWER BOARD	1
NEWBERN ELECTRIC WATER & GAS	1
OXFORD UTILITIES	1
PHILADELPHIA UTILITIES	1
RIPLEY POWER AND LIGHT	1
RUSSELLVILLE ELECTRIC BOARD	1
RUSSELLVILLE ELECTRIC PLANT BOARD	1
SMITHVILLE ELECTRIC SYSTEM	1
SPARTA ELECTRIC & WATER SYSTEM	1
SWEETWATER UTILITIES BOARD	1
TARRANT ELECTRIC DEPARTMENT	1
TRENTON LIGHT & WATER DEPARTMENT	1
TUSCUMBIA ELECTRICITY DEPARTMENT	1
WINCHESTER UTILITIES	1

Appendix B – Public Comments on the Draft EA and TVA Responses

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Appendix B – Public and Agency Comments Received on the Draft EA and TVA's Response to Comments

1. The scope of the EA being limited to only Valley Partners is inconsistent with NEPA, the TVA Act, and the TVA Mission. Are Direct Serve Customers allowed to participate under this program? If not, what is the justification for the exclusion? (*Commenters: Gill Hough; Chris Koczaja, Tennessee Solar Industries Association; Cortney Piper, Tennessee Advanced Energy Business Council*)

Response: The Flexibility Proposal fulfills a contractual commitment made by the TVA Board in August 2019 to work with the Valley Partners in good faith to provide power supply flexibility for a portion of an LPC's energy and power load. LPCs that choose not to become Valley Partners by signing the Long Term Partnership Agreement have the option to participate in the Flexibility Research Project and Green Invest. The Flexibility Proposal is a wholesale power arrangement between TVA and its wholesale power distributors who have signed the Long Term Partnership Agreement. Directly served customers are retail customers, do not have long-term contract commitments, and are not eligible to participate in the Flexibility Proposal. Directly served customers are eligible to participate in Green Invest. TVA routinely provides programs or policies tailored to the needs of specific groups of customers, and doing so is not inconsistent with the TVA Act. The TVA Act does not require that TVA offer any particular program to all customers.

2. TVA's 5 percent calculation using hourly average to determine energy is confusing and inconsistent. There is ambiguity in the customer classes included in this calculation to support TVA's methodology without further explanation. Can TVA clarify this calculation and if necessary, modify it to ensure it reflects an accurate level of applicable load to be potentially served by this proposal. Please explain or address the logic in this parameter and its current design. *(Commenters: Gill Hough; Maggie Clark, Solar Energy Industries Association; Cortney Piper, Tennessee Advanced Energy Business Council*)

Response: As described on page 2-1 of the EA, the calculation is based on an LPC's average total hourly energy sales over the last five TVA fiscal years (FY 2015 to 2019), converted to capacity basis with a minimum availability of one MW per Valley Partner. The calculated allocation for each LPC is based on the total of all customer classes with no differentiation among classes. The allocated amount would never decrease for Valley Partners. By calculating based on each LPC's average total hourly energy sales, the calculation is simple and there is no ambiguity in the customer classes included.

3. Clarification of self-generation or full requirements is needed. Are LPCs bound to TVA as the full requirements provider? (*Commenter: Gill Hough)*

Response: TVA remains the full requirements power provider for those LPCs who have become Partners by entering into the Long Term Partnership Agreement. Regardless of whether an LPC Partner exercises the option available to it under the Flexibility Proposal, TVA remains obligated to provide all LPC power needs.

4. TDEC encourages TVA to work with LPCs to streamline interconnection processes and make interconnection fees reasonable and consistent. (*Commenter: Matthew Taylor, State of Tennessee Department of Environment and Conservation*)

Response: Comment noted. Tennessee is served by more than 80 LPCs, which have electric systems that vary from small to large and from rural to urban. Consequently, they have interconnection processes reflecting that variation in system complexity. They also have a range of interconnection fees that are cost-based and reasonable. TVA will continue to work LPCs to streamline and improve interconnection processes.

5. TDEC encourages TVA to consider inclusion of provisions relating to the mitigation of fugitive dust and construction related emissions. (*Commenter: Matthew Taylor, State of Tennessee Department of Environment and Conservation*)

Response: As described on page 2-2 of the EA, TVA cannot reasonably predict the site-specific impacts of downstream activities resulting from the construction and operation of the flexibility generation facilities that would make up an LPC's self-generation. The LPCs or other facility owners/operators would be responsible for overseeing the construction and operation of the flexibility generation facilities, including the implementation of BMPs to mitigate fugitive dust and construction-related emissions under applicable law.

6. We are concerned that the Proposed Action Alternative discriminates against lower-emission sources like solar by failing to account for the differences in capacity factors between generation sources. Fair deployment of solar through this program will require a more sophisticated accounting of generation resources than nameplate capacity alone. TVA should base its flexibility caps on energy instead of capacity. (*Commenters: Chris Koczaja, Tennessee Solar Industries Association; Courtney Piper, Tennessee Advanced Energy Business Council; Stephen Smith et al., Southern Alliance for Clean Energy*)

Response: Based on feedback from its Valley Partners and on comments from the public on the Draft EA, TVA has revised the EA to incorporate an alternative that addresses this concern. Under the new alternative (Alternative B), TVA would apply a technology multiplier in the Flexibility Proposal. This alternative is described in detail in Section 2.1.3 of the Final EA. The use of the technology multiplier would allow Valley Partners to realize more comparable amounts of energy generated by natural gas-fired and solar generating facilities.

7. Several LPCs may not have the same amount of viable local options for generation resources as others. Can LPCs aggregate their capacity allocation if the project(s) are still interconnected to an LPC's distribution system? (*Commenters: Chris Koczaja, Tennessee Solar Industries Association; Maggie Clark, Solar Energy Industries Association; Courtney Piper, Tennessee Advanced Energy Business Council*)

Response: The Flexibility Proposal is designed to help individual LPCs meet the needs of their customers. Aggregation would involve complexities such as distribution wheeling. Under the Flexibility Proposal, however, requests for exceptions to the limitation on aggregation, due to circumstances such as restrictive siting, may be submitted to TVA for consideration on an individual basis.

8. It is unlikely that 100 percent of Valley Partners will participate in the program. How will TVA ensure the environmental benefits of the proposed 5 percent capacity allocation? Will TVA re-allocate capacity not used by Valley Partners to other Valley Partners who desire to procure or generate more than their 5 percent cap? (*Commenters: Chris Koczaja, Tennessee Solar Industries Association; Maggie Clark, Solar Energy Industries Association; Courtney Piper, Tennessee Advanced Energy Business Council*)

Response: No, TVA would not reallocate unused allocations. Although all Valley Partners may not implement flexible power supply options immediately, TVA anticipates that most are likely to participate within a few years. Furthermore, each allocation is specific to the Valley Partner and once a Partner executes the Flexibility Proposal contract, the specific allocation belongs to the Valley Partner in accordance with the terms and for the term of the Flexibility Proposal contract.

9. The draft EA states that 5 percent was chosen in order to maintain stability in revenue erosion and stay within the bounds of the long-term financial plan. What is the process for expanding flexibility to a larger figure in the future? TVA should put in place a mechanism to increase the flexibility level in the future. (*Commenters: Chris Koczaja, Tennessee Solar Industries Association; Courtney Piper, Tennessee Advanced Energy Business Council; Stephen Smith et al., Southern Alliance for Clean Energy*)

Response: The timing and magnitude of future expansion of LPC power supply flexibility would be dependent on and informed by, among other considerations, financial and operational results from the implementation of this Flexibility Proposal and the Flexibility Research Project. Expansion could depend on new rate structures that improve the alignment of price to cost or could include different methods for compensating LPCs for their generation. Expansion of LPC generation could be separate from the Flexibility Proposal rather than an expansion of it. Any expansion of LPC generation would be dependent on approval by the TVA Board.

10. TVA recently announced a Green Invest solar project involving the Knoxville Utility Board. In the press release, TVA boasts that the project will "produce carbon-free energy equivalent to 8 percent of KUB's annual electric load." How was the 8 percent calculated and how does this compare to the methodology behind the Flexibility Proposal? In addition, the Draft EA dismisses a potential alternative allowing flexible generation capacity of more than 5 percent on grounds of erosion of TVA revenue. How is this not a concern with the 8 percent capacity of the KUB project? (*Commenters: Maggie Clark, Solar Energy Industries Association*)

Response: Thank you for your interest in Green Invest. The 8 percent calculation was announced in a public statement to express the magnitude and importance of the project to KUB and reflects an estimate of the anticipated annual generation by the project. The KUB Green Invest project has different wholesale power arrangements and compensation structures than the Flexibility Proposal, making a direct comparison between the KUB proposal and the Flexibility Proposal not meaningful. Specifically, under the Flexibility Proposal, KUB would retain and distribute the power generated by the flexible generation assets; TVA would have lower sales to KUB and the associated loss of revenues. In contrast, TVA will purchase the generation from the Green Invest project from KUB while power sales to KUB will remain unaffected. Under the Flexibility Proposal, the 5 percent of available flexible power would be based on the LPC's average total hourly energy sales over the last five TVA fiscal years (FY 2015 to 2019), converted to capacity basis with a minimum availability of one MW per Valley Partner.

11. Valley Partners have been told that the 5 percent excludes large power users and is only applied to standard service customers. This would arbitrarily put further limits on the capacity available. Can TVA please clarify this calculation, its methodology, and the logic behind any exclusion of LPC-served industrial customers? (*Commenters: Chris Koczaja, Tennessee Solar Industries Association; Courtney Piper, Tennessee Advanced Energy Business Council*)

Response: The electrical energy purchased by LPC-served industrial customers is not excluded in the calculation. As explicitly stated in the first bullet of Section 2.1.2 of the EA, the 5 percent is applicable to each LPC's average total hourly energy sales over the last five TVA fiscal years.

12. We strongly encourage TVA to partner with an organization to offer education around the state and Valley to assist LPCs in selecting technologies. (*Commenter: Courtney Piper, Tennessee Advanced Energy Business Council*)

Response: Thank you for your expression of interest. Your comment is noted.

13. NCDA submitted responses from a variety of entities concerning the specific regulatory and permitting requirements as facilities are constructed, including regulations related to sediment control, underground storage tanks, existing utility lines, solid waste management, protection of historic properties, and floodplain management. (*Commenter: Crystal Best, State of North Carolina Department of Administration*)

Response: Under the terms of the proposed action, LPCs or other project owners/operators would be responsible for obtaining the appropriate state and federal permits associated with the construction and operation of any generating facilities necessary to implement the Flexibility Proposal.

14. The description of the Flexibility Research Project should be revised to note that it was developed by and is jointly administered by the Tennessee Valley Public Power Association. (Commenter: *Steve Noe, Tennessee Valley Public Power Association*)

Response: TVA has revised the text on page 1-3 of the Final EA to incorporate reference to TVPPA's role in the FRP.

15. TVA suggests that 5 percent will provide sufficient flexibility to meet LPCs' need and will be something that is of interest to the LPCs. TVA does not provide evidence that its Flexible Proposal is "sufficient." Our experience elsewhere indicates some LPCs want a much higher flexible generation capacity. (*Commenters: Peter D. Schleider, RKB Energy; Stephen Smith et al., Southern Alliance for Clean Energy*)

Response: The statement that 5 percent would provide LPCs sufficient flexibility was based on feedback from and conversations with various LPCs, customer service representatives, and TVA experts regarding current needs. See also the response to Comment 9 (above) relating to future expansion of LPC power supply flexibility.

16. Please provide the analysis TVA used to determine that allowing LPCs to generate more than the proposed 5 percent cap would impose a high risk on TVA's financial plan. What are the specific revenue requirements for TVA to avoid significant negative impacts to the financial plan? (*Commenter: Stephen Smith et al., Southern Alliance for Clean Energy*)

Response: The potential revenue erosion from a proposal that provides flexibility of more than 5 percent would be greater in magnitude than revenue erosion from a proposal that provides up to 5 percent flexibility. While risk of revenue erosion from a 3–5 percent Flexibility Proposal would be offset by the expected benefits of rate and financial stability from longer commitment periods, increased revenue erosion from a higher percentage of flexible generation could trigger a rate increase, necessitate a rate structure change, or inhibit TVA's ability to pay down debt.

17. Please provide the caps in total MW for each LPC. (*Commenter: Stephen Smith et al., Southern Alliance for Clean Energy*)

Response: The Final EA includes a table listing the proposed flexible power supply allocations for each LPC in Appendix A.

18. Given that TVA uses discounted capacity values for intermittent resources in its IRP, is there a plan to use these same capacity values when counting solar resources against each LPC's capacity cap? Or will 100 percent of solar's nameplate capacity be counted against each LPC's capacity cap? (*Commenter: Stephen Smith et al., Southern Alliance for Clean Energy*)

Response: See the response to Comment 6.

19. What capacity factors were used for each resource type to assess Scenarios 1-3 as described in the draft EA? (*Commenter: Stephen Smith et al., Southern Alliance for Clean Energy*)

Response: The assessment of Scenarios 1–3 in the draft EA is based on nameplate capacity. In the final EA, nameplate capacities are used in assessing Scenarios 1–3 for Alternative A (the Proposed Action Alternative in the draft EA). For Alternative B, Scenarios 1–3 are assessed using nameplate capacities and using the technology factor to compute available solar nameplate capacity.

20. What is meant by the statement “the pricing of flexible generation would be the prevailing wholesale rate” on page 2-2? If an LPC chooses to implement flexibility through a net metering program, are they required to pay distributed solar generators the TVA wholesale rate for what they generate or can an LPC set its own net metering rates? (*Commenter: Stephen Smith et al., Southern Alliance for Clean Energy*)

Response: LPCs pay for wholesale service based on the rates, terms, and provisions within their wholesale rate schedule. LPCs participating in flexible generation would have less metered wholesale usage; therefore, their wholesale power invoice would be reduced. The reduction in the LPC’s wholesale bill attributable to their flexible generation would be at the prevailing wholesale rate. Each participating LPC would design and implement retail power arrangements appropriate for its needs and situation, subject to TVA regulatory review and approval.

21. Stand-alone batteries are not listed as either eligible or ineligible. Since batteries would not offset an LPC's energy needs, but could potentially offset an LPC's demand charges, are they considered within this program? (*Commenter: Stephen Smith et al., Southern Alliance for Clean Energy*)

Response: Under the proposal, stand-alone batteries would not be eligible under this program. However, batteries integrated with qualifying flexible generation would be eligible.

22. TVA's program does not provide clear evidence of the emissions impact. To ensure that the program does not increase emissions of carbon dioxide or any other pollutant TVA should limit the resources eligible to participate in the program to renewable and CHP resources. (*Commenter: Stephen Smith et al., Southern Alliance for Clean Energy*)

Response: The types of generating resources eligible for use by LPCs under the Flexibility Proposal are the same as those included in the TVA IRP. The anticipated impacts of the flexibility program alternatives on air quality are described in Section 3.4 of the EA. Given the allowable types of flexible generation, neither Alternative A nor Alternative B is expected to result in an increase in the emissions of air pollutants, including carbon dioxide, by the TVA

power system over the emissions under the No Action Alternative. Both Alternative A and Alternative B have the potential to reduce emissions, since flexible solar generation would likely offset natural gas-fired generation. The amount of emission reductions increases with the proportion of flexible solar generation and is potentially greater under Alternative B than Alternative A.

23. TVA did not adequately consider alternatives to its Flexibility Proposal. Such alternatives include an alternative allowing more than 5 percent of flexible generation and an alternative method for calculating flexible generation, such as a zero-carbon alternative that would allow LPCs to generate up to 5 percent of their average annual demand but would limit that generation to zero-carbon resources. (*Commenter: Stephen Smith et al., Southern Alliance for Clean Energy*)

Response: Since the publication of the draft EA, TVA has developed an additional action alternative described as Alternative B in Section 2.1.3 of the Final EA. This alternative greatly increases the capacity of solar generation that could be installed by Valley Partners. For a discussion of alternatives that would allow greater than 5 percent flexible generation, see the revised Section 2.1.4.1 of the Final EA and the responses to comments 35 and 37.

24. TVA made an error when calculating flexible generation quantities. TVA did not account for at least one leap year during the 5-year calculation period. This is a small but important difference. (*Commenter: Stephen Smith et al., Southern Alliance for Clean Energy*)

Response: The additional day during the 2016 leap year was included in the flexibility allocation calculations. Appendix A of the Final EA lists the proposed flexible power supply allocations for each LPC.

25. TVA has failed to meaningfully engage the public as required by NEPA by establishing a short comment period and denying requests to extend it during an unprecedented public health crisis that limits advocates' participation in the process, by failing to give the public an opportunity to comment on the Long-Term Contract before implementing the Agreement, and by refusing to produce requested documents necessary for the public to fully and meaningfully comment on the Draft EA. (*Commenter: Amanda Garcia et al., Southern Environmental Law Center et al.*)

Response: For environmental assessments, TVA normally provides a 30-day public comment period. Based on TVA's experience, this period of time is sufficient for the public to review and provide comments on a draft EA. TVA is encouraged with the number of public comments received from the public, organizations, and stakeholders, including the substantial input provided by the commenter during the review period. TVA believes that the duration of the comment period was adequate and has helped facilitate timely and meaningful public input.

During the review period, TVA received requests for additional information under the Freedom of Information Act (FOIA). TVA responded to the requests by providing the information on the TVA project webpage as soon as possible, and well in advance of the time period applied under FOIA. TVA notes that the commenter provided comments relating to this additional information during the comment period that were considered by TVA in finalizing the EA.

26. TVA failed to evaluate the Long-Term Contract in an EIS. Such an EIS was required for the following reasons:

- The TVA Board of Directors' adoption of the Long-Term Contract is a major federal action with potentially significant environmental impacts. The Long-Term Contract is an official agency policy subject to NEPA, 40 C.F.R. § 1508.18(b)(1) that governs TVA's business with at least 138 LPCs for a time period that is essentially in perpetuity. The Long-term Contract will affect air quality, public health, clean-energy jobs, and energy usage across the TVA territory.
- By locking LPCs into perpetual service, the Long-Term Contract insulates TVA from competitive pressure to provide more access to renewables, energy efficiency programs, and DERs, all with potentially lower environmental impacts.
- The potential environmental impacts of the Long-Term Contract, due to its constraints on an LPC's ability to utilize renewable energy and the resulting environmental impacts, is highly controversial as shown by the current deliberations with Memphis Light, Gas, and Water. (Commenter: *Amanda Garcia et al., Southern Environmental Law Center et al.*)

Response: Prior to the August 2019 meeting of the TVA Board of Directors, TVA environmental compliance staff reviewed the Board's resolution to determine whether the action was subject to review under the National Environmental Policy Act. The Long-Term Agreement resolution approved by the TVA Board provides LPCs a bill credit (Partnership Credit) in exchange for LPCs extending their contract termination notice to 20 years. The Partnership Credit and the lengthening of the contract period were the two main features of the Board's 2019 decision. While the Long-Term Agreement resolution committed TVA to negotiating flexibility arrangements with LPCs, no flexibility proposal had taken shape at the time the Board approved the Long-Term Agreement resolution in August 2019. TVA determined that the Partnership Credit has the effect of a wholesale rate adjustment because it would reduce future wholesale bills without changing the existing rate structure. Predicting how the bill credit would affect the end user would be purely speculative. And the lengthening of the contract period (from 5- or 10-year terms to a 20-year term for interested LPCs) would have the effect of continuing the status quo since current environmental conditions would continue under the proposal without change. This conclusion is further supported by resource planning studies that TVA conducts annually (and also for the TVA IRP), which already incorporate the assumption of serving LPC demand for 20 years regardless of the actual level of commitment under the contract. The 2019 Board decision was thus not subject to NEPA review.

Further, under the "full requirements" provision of TVA's previous/existing contracts with LPCs, TVA commits to providing all power sold in the LPC service area and the LPC commits to using only TVA power, unless otherwise agreed to by both parties. The "full requirements" commitment is not changed under the Long-Term Agreements, which would maintain the existing terms of the wholesale power contract and, thus, would not change levels of competitive pressures in the TVA service area.

The LTP agreement provided a potential path to enhance LPC self-generation, dependent upon successful negotiations with Valley Partners and realized in the Flexibility Proposal. Rather than stifling access to renewables and DERs, the Flexibility Proposal would incentivize them. Additionally, TVA continues to facilitate implementation of renewables and DERs with the Flexibility Research Project and the Green Invest program. These programs are described in Section 2.1.1 of the EA.

Contract negotiations with Memphis Light, Gas, and Water were ongoing prior to the development of the LTP agreement and are not indicative of controversy attributable to the LTP agreement. Indeed, the rapidity with which many LPCs embraced the LTP agreement are indicative of a lack of controversy attributable to the LTP agreement and its provisions.

It would have been premature to conduct an environmental review of the Flexibility Proposal at the time the Board approved the Long-Term Agreement resolution in August 2019 because the specifics of the Flexibility Proposal had not been formulated at that time. The 2019 resolution only directed TVA to negotiate with LPCs to provide additional power supply flexibility for a specified portion of an LPC's energy power load. Following the Board's August 2019 resolution, TVA committed to collaborate with LPCs to develop a plan for 3 to 5 percent of the LPC's energy, which would not foreclose TVA agreeing to a higher amount of flexibility. Discussions with LPCs led to the formation of the Flexibility Proposal to provide power supply flexibility for 3 to 5 percent of an LPC's energy load. The Board approved this proposal in February 2020 subject to completion of any required environmental reviews. This approval instructed TVA to implement the Flexibility Proposal on the later date of June 1, 2020 or the date on which all required environmental reviews are satisfactorily completed. This EA has been developed to review the impacts of the Flexibility Proposal consistent with the Board's direction. The Flexibility Proposal will not be implemented until this NEPA review is complete.

27. The Long-Term Contract and the Flexibility Proposal are connected actions that must be analyzed in the same NEPA document. Together, they meet the definition of connected actions (40 C.F.R. § 1508.25(a)(1)) because the Flexibility Proposal "cannot or will not proceed unless other actions are taken previously or simultaneously," because the Flexibility Proposal is only available to local power companies that have signed the Long-term Contract; the Long-term Contract "automatically trigger[s]" the Flexibility Proposal because the development and implementation of the Flexibility Proposal is a term of the Long-term Contract; and the Long-term Contract and Flexibility Proposal are properly viewed as "interdependent parts of a larger action" that "depend on the larger action for their justification." (*Commenter: Amanda Garcia et al., Southern Environmental Law Center et al.*)

Response: While the commitment to develop a flexibility option is included in the terms of the Long-Term Agreement, the specific proposal for LPC flexible generation was developed later. The extension of the termination notice period to 20 years in exchange for a wholesale bill credit were the main features of the Board's resolution approved in August 2019. In that resolution, the Board merely directed TVA staff to negotiate with LPCs to develop a Flexibility Proposal. At that time, a meaningful environmental review of the Flexibility Proposal was premature as no specific proposal had taken shape. In the following months, the proposal evolved as TVA held discussions with LPCs on issues such as the portion of an LPC's energy and power load that could be met through self-generation and the manner in which this load should be calculated. These discussions ultimately resulted in a specific proposal that was presented to the TVA Board in February 2020. The Board approved this Flexibility Proposal in February 2020 subject to completion of any required environmental reviews. This approval instructed TVA to implement the Flexibility Proposal on the later date of June 1, 2020 or the date on which all required environmental reviews are satisfactorily completed. This EA has been developed to review the impacts of the Flexibility Proposal consistent with the Board's direction. The flexibility proposal will not be implemented until this NEPA review is complete.

28. TVA did not invoke a categorical exclusion for the Long-Term Contract and the claim that it determined that NEPA did not apply to the Long-Term Contract is erroneous. By issuing the EA on the Flexibility Proposal, TVA has essentially conceded that the Long-term Contract—of which the Flexibility Proposal is an express term—required NEPA review before implementation. Had TVA decided to categorically exclude the Long-Term Contract, TVA's categorical exclusion on contracts for the sale of electricity would not have been applicable because the contract, by its inclusion of the Flexibility Proposal, will spur the expansion or development of facilities and

transmission infrastructure. (*Commenter: Amanda Garcia et al., Southern Environmental Law Center et al.*)

Response: TVA did not apply a categorical exclusion for the Board's decision in 2019 to approve the terms of a standard long-term agreement to be entered into between TVA and interested LPCs. This was because, for the reasons provided above under responses to Comments 26 and 27, the Board's decision to approve the terms of a standard long-term agreement was not subject to NEPA review. The Board's 2019 decision merely committed TVA to negotiate in good faith with LPCs to provide additional power supply flexibility. These negotiations with LPCs ripened into a concrete flexibility proposal which was then approved by the Board in February 2020 subject to satisfactory completion of any required environmental reviews.

29. The Flexibility Proposal will significantly affect the environment and requires an EIS. Significant effects will occur to air quality, public health, clean-energy jobs, and the impacts on the rates paid and energy used by LPC customers. Under the Proposed Action Alternative, these impacts are likely to be greater than they would otherwise be due to the imposed constraints on LPCs use of renewable energy, promotion of energy efficiency programs, and other factors. These constraints result from the proposal's principles that limit LPC's self-generation; require flexible generation to be built within the LPC's service territory; maintain TVA's obligation to provide the full power requirements of Valley Partners, thereby giving zero capacity value to flexible generation and likely causing TVA to delay plant retirements; and require that flexible generation be consistent with TVA's IRP, thereby promoting fossil gas-burning generation. (*Commenter: Amanda Garcia et al., Southern Environmental Law Center et al.*)

Response: TVA disagrees that the proposal would result in significant environmental impacts and that an EIS is necessary. TVA has considered requirements of the Council on Environmental Quality at 40 CFR 1508.27 regarding how significance is determined. While TVA agrees with the commenter that the proposal has regional context and may result in environmental impacts, TVA has found that none of the impacts would be significant.

As discussed in Section 3.2.2, the proposal would provide Valley Partners the flexibility to provide a portion of their own energy load that would otherwise be provided by TVA. Generally, CHP generation would offset generation that would otherwise be provided by natural gas-fired combined cycle and coal-fired generators. TVA anticipates that solar generation and non-CHP natural gas-fired generation (i.e., RICE generation) provided by LPCs under the three deployment scenarios during the early years of the 20-year IRP planning period would largely offset natural gas-fired generation that would have been provided by TVA. During later years of the IRP planning period, flexible solar and RICE generation would offset both TVA solar and natural gas-fired generation. Generally, any impacts would be limited due to the relatively small proportion of TVA's overall generating capacity that would be provided by LPCs under the Flexibility Proposal (either Alternative A or B), and the Flexibility Proposal is unlikely to markedly alter the TVA long-term power supply plan or the timing of the construction of new generating capacity and retirement of existing generating capacity.

The commenter states that limiting the amount of energy LPCs could generate under the proposal results in greater impacts on the environment than would be the case otherwise, without specifying what those impacts would be or why they should be considered significant. Nor does the commenter acknowledge that some environmental impacts (e.g., impacts to land resources) would increase if the amount of energy LPCs could generate were expanded.

Likewise, commenter states that restricting new generation to within the service area of a Valley Partner results in greater environmental impacts, but provides little support for this assertion. Restricting new generation to within the Valley Partner's service territory is appropriate because the Flexibility Proposal is designed to help individual LPCs meet the needs of their respective customers. Furthermore, aggregation involves complexities such as distribution wheeling. However, under circumstances such as restrictive siting, TVA would consider requests for exceptions on an individual basis.

The commenter states that continuing to obligate Valley Partners to the full power requirements would likely lead TVA to operate its plants longer than otherwise necessary. TVA disagrees. As noted above, TVA addressed this concern in Section 3.2.2 of the EA and stated that the Flexibility Proposal it is unlikely to alter the timing of TVA's retirement decisions.

The commenter also expresses concern that the generation selected by Valley Partners should be consistent with TVA's IRP. Consistency with the IRP is one of the principles of the Flexibility Proposal because this ensures that TVA's carbon position continues to improve. As noted on page 3-1 of the EA, TVA considers Deployment Scenario 2 (90 percent solar generation and 10 percent natural gas-fired generation) to be the most likely deployment scenario. TVA analyzed the impacts of natural gas-fired generation in its EA. The commenter does not offer any specific comment on the adequacy of that analysis.

The determination by TVA that Scenario 2 is the most likely deployment scenario is based on discussions with its LPCs regarding flexibility and their customers' needs and demand (EA p. 3-1). During the preparation of the EA, TVA relied on these interactions and its knowledge of the interests and needs of LPCs to evaluate potential development scenarios. TVA does not agree with the comment that a majority of flexible generation would be natural gas-fired generation. The statement is unsupported. To ensure TVA's carbon goals are met, TVA would maintain discretion under the Flexibility Proposal to eliminate natural gas-fired generation as a generation option if its system carbon position is not improved from implementation of the proposal.

30. Tiering the Draft EA to the 2019 IRP EIS is inappropriate for two reasons. First, the IRP EIS did not analyze the effects of actions like the Flexibility Proposal. Although the Draft EA references the description of DER in the IRP EIS, the Flexibility Proposal includes natural gas-fired generation which is not a DER in the IRP EIS and omits energy efficiency and demand response, which are included as DER in the IRP EIS. The Draft EA acknowledges that "The 2019 IRP EIS did not provide general information about generating resources of the scale contemplated in the Flexibility Proposal," meaning, apparently, relatively small-capacity installations. The Draft EA also denies any capacity value to flexible generation by stating "the Proposed Action Alternative is unlikely to markedly alter the TVA long-term power supply plan [i.e., the IRP] or the timing of the construction of new generating capacity and retirement of existing generating capacity." This is contrary to the IRP EIS where DER decreases demand and TVA capacity requirements. (*Commenter: Amanda Garcia et al., Southern Environmental Law Center et al.*)

Response: The statement "The 2019 IRP EIS did not provide general information about generating resources of the scale contemplated in the Flexibility Proposal," is incorrect and has been revised in the final EA. The IRP EIS provides general, non-site specific information in Section 5.2 about the environmental impacts of solar generating facilities over the range of capacities likely to be constructed for LPC flexible generation. It is therefore appropriate for the EA to tier from the IRP EIS to incorporate this information, as well as other information about the environmental impacts of the long-term power supply plan. The potential environmental impacts

of gas-fired generation and combined heat and power generation likely to be constructed for LPC flexible generation are described in Section 3 of the EA.

TVA does not assume that flexible generation has no capacity value. TVA's long-term power supply plan as presented in the IRP is based on a range of future power demands, DER adoption levels, and other variables. The reduced demand for TVA-generated power that would result under either Alternative A or Alternative B, with full potential flexible generation build-out under Scenarios 1, 2, or 3, is within the ranges in TVA's long-term power supply plan under conditions of lower demand and/or higher DER adoption.

31. The second reason why tiering is inappropriate is that the IRP EIS did not take into account the effect of a rate discount, a component of the Long-Term Contract, on future power demand. The IRP EIS assumes that DER deployment will decrease demand. Assuming the Valley Partners will pass at least some of the 3.1 percent wholesale discount on their customers, the discount will increase demand (as supported by a study by Greenlink Analytics). (*Commenter: Amanda Garcia et al., Southern Environmental Law Center et al.*)

Response: As discussed in the response to Comment 26 above, the Long-Term Agreement resolution approved by the Board in 2019 did not require an environmental review. Furthermore, the Partnership Credit provided to Valley Partners by the LTP agreement was not a retail rate decrease. There is no requirement that Valley Partners pass any portion of the credit to their retail customers. Electricity demand in the Tennessee Valley is historically inelastic. Given that the Partnership Credit applies only to the invoices of 140 Valley Partners, that it applies only to approximately 75 percent of wholesale invoice charges of the Valley Partners, that fewer than 10 percent of the Valley Partners (representing 5 percent of the electric sales eligible for the LTP credit) have decreased their retail rates, and that historically a 1 percent decrease in prices results in an estimated increase in usage of 0.15 percent, there is no measurable increase in usage attributable to the Partnership Credit. The Greenlink Analytics study provided to TVA is flawed because it includes, among other things, assumptions that all 154 LPCs would sign an LTP agreement and would fully pass along the wholesale credit to retail consumers. To date, neither have occurred and it would be speculative to assume that either would occur.

32. The Draft EA purports to "tier its analysis to address more site-specific impacts that may occur based on likely local power company deployment scenarios," but the EA does not analyze any site-specific impacts. Such impacts were also not analyzed in the IRP EIS. (Commenter: *Amanda Garcia et al., Southern Environmental Law Center et al.*)

Response: Comment noted. The quoted statement is incorrect and has been revised in the final EA to explain that the EA does not assess site-specific impacts due to the lack of information on where Valley Partners may construct flexible generating facilities. The EA does describe the potential impacts to many environmental resources (e.g., air, water, land, waste) in a generic, non-site-specific context and to the extent foreseeable. TVA would have no control or responsibility over the siting, construction, or operation of Valley Partners' flexible generation. Valley Partners bear the responsibility of complying with all applicable laws and regulations.

33. The Draft EA incorporates by reference TVA's 2018 Wholesale Rate Change EA. This is improper and the brief description of the rate-change EA is insufficient for incorporation. (*Commenter: Amanda Garcia et al., Southern Environmental Law Center et al.*)

Response: TVA incorporated by reference information on minority and low-income populations from the 2018 Wholesale Rate Change EA into the Affected Environment Section 3.3.1.2 of the

Flexibility EA. Incorporating such information into an EA has been encouraged by CEQ. CEQ has advised agencies to incorporate "background data" to support its discussion in order to "avoid undue length" of EAs. TVA appropriately cited to the 2018 EA and provided a summary of the relevant information in Section 3.3.1.2. (40 Most Commonly Asked Questions Concerning CEQ's NEPA Regulations, question #36a, 46 FR 18026, March 23, 1981; as amended (1986)). TVA is not tiering to the 2018 Wholesale Rate Change EA.

34. TVA inappropriately predetermined the outcome of its NEPA analysis by rolling out the Long-term Contract and promising local power companies a flexibility option by October 1, 2021 that allowed between three and five percent flexible generation, entering into at least 138 contracts with terms of 20 plus years, and only now producing an inadequate environmental analysis of the Flexibility Proposal, without ever having analyzed the impacts associated with the Long-term Contract as a whole. This resulted in TVA irreversibly and irretrievably committed itself to a plan of action that is dependent on the NEPA environmental analysis producing a certain outcome before TVA completed that environmental analysis. This commitment occurred when TVA began signing Long-term Contracts in August, 2019. (*Commenter: Amanda Garcia et al., Southern Environmental Law Center et al.*)

Response: TVA disagrees that the outcome has been predetermined. No irreversible or irretrievable commitments of resources were made prior to the Board's approval of the Flexibility Proposal in February 2020. The Board did not approve the 3–5 percent Flexibility Proposal at the time it approved the terms of the LTP agreement in August 2019 because the Flexibility Proposal had not been developed at that time. This 2019 approval only directed TVA to negotiate with LPCs to provide additional power supply flexibility for a specified portion of an LPC's energy power load.

The LPC contracts referenced by the commenter include a commitment to collaborate with LPCs to develop a plan for 3 to 5 percent of the LPC's energy, but did not foreclose TVA agreeing to a higher amount of flexibility. Valley Partners have the option to terminate the LTP agreement if this commitment is not met. The Board's approval of the proposal in February 2020 satisfies this commitment. Further, Valley Partners also have the right to terminate the contract if it does not agree to the Board's approved Flexibility Proposal. All of this confirms the reversible nature of the commitments made in these LPC contracts concerning the Flexibility Proposal.

35. TVA's alternative analysis is arbitrary and capricious due to an impermissibly narrow statement of purpose and need. TVA states that the purpose and need for the proposed action is to: (1) enhance the Valley's energy resource development, and (2) respond to customer demand for renewable energy resources. However, in describing the Purpose and Need for the Proposed Action, TVA repeatedly references it commitment in the Long-term Contract to "develop an option for power supply flexibility for Valley Partners to generate up to five percent of energy." By including the five percent limit of any power flexibility option in its statement of purpose and need TVA assured that only one alternative—the Proposed Action Alternative—could be selected. TVA has not provided any quantitative analysis of why the five percent cap is necessary to ensure its "financial health" or any reason why higher levels of solar generation are not considered. (*Commenter: Amanda Garcia et al., Southern Environmental Law Center et al.*)

Response: The Long-Term Agreement resolution approved by the TVA Board in August 2019 did not identify a specific flexibility option and only stated that such an option would be negotiated in good faith with interested LPCs. The Purpose and Need section of the EA has

been revised to accurately reflect the direction given by the Board in August 2019 for the development of a flexibility option.

As noted in the EA, TVA did consider alternatives of greater than 5 percent of self-generation by an LPC but dismissed the alternatives from further consideration for reasons expressed in Section 2.1.4.1. TVA has updated Section 2.1.4.1 to provide additional information regarding the consideration of financial risk and business impacts associated with an alternative with greater than 5 percent flexibility.

36. TVA's alternative analysis is arbitrary and capricious due to the unrealistic No Action Alternative. This alternative states that TVA would continue to implement the Long Term Contracts without the power supply flexibility options. However, the environmental impacts of the Long Term Contract, as noted elsewhere in our comments and including increased demand and potentially reduced adoption and viability of energy efficiency programs and distributed solar, have not been analyzed. The No Action Alternative also does not account for changes in the number of Long Term Contract participants if the Flexibility Proposal is not adopted. Several LPCs, including many of the largest, have already shown a strong interest in developing renewable project at a local scale without the availability of the Long Term Contract. (*Commenter: Amanda Garcia et al., Southern Environmental Law Center et al.*)

Response: The No Action Alternative included in the EA is a reasonable baseline alternative from which to analyze the potential impacts of TVA's proposal. It represents the present course of action as reflected by the options TVA currently provides to LPCs, including programs open to all LPCs (e.g., Flexibility Research Project, Green Invest). It would be unreasonable to assume otherwise, given that the LTP agreement currently defines the contractual terms between TVA and some 140 LPCs.

Based on feedback from Valley Partners, TVA estimates that fewer than 10 percent of the current 140 Valley Partners would terminate the LTP agreement if a flexible generation option is not adopted. TVA has revised the EA to include this estimation. The description of the No Action Alternative also includes the ongoing Flexibility Research Project and the Green Invest program in order to reflect the opportunities and programs that LPCs could utilize to develop distributed energy, regardless of whether TVA adopts a flexibility option for Valley Partners. In this way, the alternative addresses those LPCs that may terminate their agreement.

See the response to Comment 26 relating to TVA's consideration of NEPA requirements pertaining to the Long-Term Agreement resolution approved by the Board in 2019. TVA notes that the LTP agreement would not affect TVA's generation portfolio mix. Lengthening of the contract period (from typical 5- to 10-year terms to a 20-year term) would not affect the current forecast for the 20-year horizon. This is confirmed by TVA planning studies, which are conducted annually, as well as for the TVA Integrated Resource Plan. These studies incorporate the assumption of serving LPC electricity demand for 20 years regardless of contract terms. Therefore, the lengthening of the contract to a 20-year term under the LTP agreements would still be within the analytical boundaries of the annual planning studies and the 2019 Integrated Resource Plan. In addition, the "full requirements" provision of TVA's existing contracts with LPCs is not changed by the LTP agreements. These facts offer additional reasons for presenting the No Action Alternative as TVA has in the EA.

37. TVA's alternative analysis is arbitrary and capricious due to the failure to analyze a reasonable range of alternatives. The Draft EA briefly considers and dismisses two additional alternatives: Flexible Generation of Greater than Five Percent and Expansion of the TVA

Flexibility Research Project. The alternative of greater than five percent flexible generation is dismissed with inadequate explanation and reliance on the commitment in the Long Term Contract, which itself violated the NEPA process. The conclusory assertions of “higher risk to the financial plan” and imbalance of “risk of revenue erosion with the expected benefits of rate and financial stability from longer commitment periods” lack any analytical justification. The alternative analysis also does not consider reasonable alternatives that would meet TVA’s stated purpose of further enhancing the Tennessee Valley’s resource diversity and responding to customer demand for renewable energy resources, such as a Zero-Carbon Alternative. (*Commenter: Amanda Garcia et al., Southern Environmental Law Center et al.*)

Response: As described in Section 2.1 of the EA, TVA considered several potential alternatives. To clarify its reasons for eliminating alternatives from detailed analysis, TVA has added information to further explain the elimination of certain alternatives. TVA has revised the discussion in Section 2.1.4.1 addressing consideration of an alternative with greater than 5 percent flexible generation by providing more information on the risk to TVA's financial plan. A zero-carbon alternative was not considered because it would have eliminated combined heat and power generation and not met the expressed need of some LPCs.

38. The analysis of impacts is deficient because of the failure to consider the indirect effects of granting preference to LPCs that sign the Long Term Contract. According to TVA, Valley Partners “generally receive commercial terms reflective of the long-term commitment they have made to the Valley, resulting in more favorable solution for their customers.” This is assumed to include favorable infrastructure development. The timing of the signing of the Long Term Contract by Knoxville Utility Board, after engaging TVA in a partnership agreement under the Green Invest program to apply a portion of its Valley Partner credit to a large solar project, is evidence of such a “more favorable solution.” The indirect effects of such infrastructure development are not considered. (*Commenter: Amanda Garcia et al., Southern Environmental Law Center et al.*)

Response: The assertion that the benefits of the LTP agreement include “favorable infrastructure development” beyond that available to all LPCs is incorrect. The Green Invest project with KUB is a stand-alone project to build a new, large-scale renewable energy facility through a competitive bid process. It is not a component of the Flexibility Proposal. The Green Invest program, described in Section 1.3 of the EA, is open to local power companies, businesses, and industrial customers across TVA’s service territory. Participation in the Green Invest program does not require the execution of an LTP agreement. The choice by KUB to direct a portion of the Partnership Credit received under their LTP agreement with TVA to fulfill KUB’s March 2020 commitment to new renewable energy is an example of how an LPC can exercise local control to accomplish local goals and initiatives as a Valley Partner.

39. The EA fails to consider the cumulative impacts of the Long Term Contract. These cumulative impacts arise from locking LPCs into long term contracts, insulating TVA from the competitive pressure of increasing renewable generation, restricting LPCs to a five percent capacity limit, and allowing TVA to maintain a less competitive generation portfolio. These actions will have significant cumulative impacts as discussed elsewhere in our comments, including slowing the growth of renewables and harming public health. TVA’s expectation to the contrary is unsupported and unexplained. (*Commenter: Amanda Garcia et al., Southern Environmental Law Center et al.*)

Response: TVA has revised the discussion of cumulative impacts in the EA by adding information relating to the LTP agreement. As noted in the response to Comment 36, and in the

revised analysis, TVA does not foresee that the agreement would have an effect, significant or otherwise, on TVA's generation portfolio mix. This is confirmed by TVA planning studies, which are conducted annually as well as for the TVA Integrated Resource Plan. These studies incorporate the assumption of serving LPC electricity demand for 20 years regardless of the actual level of commitment under the contracts. Therefore, the lengthening of the contract to a 20-year term under the LTP agreement would still be within the analytical boundaries of the annual planning studies and the 2019 Integrated Resource Plan review. In addition, the "full requirements" provision of TVA contracts with LPCs is no different under a long-term agreement or existing LPC agreements.