Integrated Resource Plan 2024

SCOPING REPORT

TVA TENNESSEE VALLEY AUTHORITY

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Symbols, Acronyms, and Abbreviations

Acronym	Description
CBD	Center for Biological Diversity
CFR	Code of Federal Regulations
DER	Distributed Energy Resources
DSM	Demand-side Management
EE	Energy Efficiency
EIS	Environmental Impact Statement
EJ	Environmental Justice
EO	Executive Order
EPA	U.S. Environmental Protection Agency
GHG	Greenhouse Gas
IRA	Inflation Reduction Act
IRP	Integrated Resource Plan
IRP-WG	Integrated Resource Plan Working Group
LPC	Local Power Company
NEPA	National Environmental Policy Act
NOI	Notice of Intent
SMR	Small Modular Reactor
TVA	Tennessee Valley Authority
U.S.C.	United States Code

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1 Introduction

The Tennessee Valley Authority (TVA) is conducting a study of energy resources to determine how TVA can best meet future electricity demand. The resulting 2024 Integrated Resource Plan (IRP) will update and replace TVA's 2019 IRP. TVA has initiated the preparation of an environmental impact statement (EIS) pursuant to the National Environmental Policy Act (NEPA) to assess the environmental impacts of adopting a 2024 IRP.

The EIS analyzes environmental impacts to the TVA region, which is composed of the Tennessee River watershed and the TVA power service area (Tennessee and portions of Alabama, Georgia, Kentucky, Mississippi, North Carolina and Virginia) (see Figure 1), that could result from the potential power supply mix studied in the IRP.

TVA will use the environmental review process to engage stakeholders; identify issues, trends, events, and tradeoffs affecting TVA's policies; formulate, evaluate, and compare alternative portfolios of energy resource options; provide opportunities for public review and comment; and ensure that TVA's evaluation of alternative energy resource strategies reflects a full range of stakeholder input.

On May 19, 2023, TVA issued a Notice of Intent (NOI) in the Federal Register to conduct the environmental review for the next IRP in accordance with NEPA. Public comment was invited concerning the IRP, the scope of the EIS, and environmental issues that should be addressed in the EIS. Additionally, TVA invited specific comments related to a few questions that will be answered by the IRP study. TVA published the NOI and information about the next IRP on the TVA website www.tva.com/irp (see Attachment A for the NOI). TVA issued a press release to more than 300 news outlets, including local, state, national, and trade source, and requested public comments through social media channels. TVA also notified numerous individuals, organizations, and agencies of the NOI (see Appendix A). The NOI was posted on TVA's IRP website on May 19, 2023, and the May 25, 2023, publication of the NOI in the Federal Register initiated a 45-day public scoping period, which concluded on July 3, 2023.

This Scoping Report describes the internal and public scoping for relevant issues relating to this effort and the outreach conducted by TVA to notify the public. The Scoping Report also documents the comments submitted to TVA by the public, companies, organizations, and agencies during the 45-day public scoping period.

2 Background

TVA operates the nation's largest public power system, providing electricity to about 10 million people in an 80,000-square-mile area in the TVA region. TVA provides wholesale power to 153 independent local power companies and 58 directly served large industrial and federal facilities. The TVA Act of 1933, as amended, requires the TVA power system to be self-supporting and operated on a nonprofit basis and directs TVA to sell power at rates as low as are feasible.

The TVA power system generates approximately 38,000 megawatts. Most of the power TVA distributes is generated with its three nuclear plants, five coal-fired plants, nine simple-cycle combustion turbine plants, eight combined-cycle combustion turbine plants, 29 hydroelectric dams, a pumped-storage facility, a diesel-fired facility, and 13 solar photovoltaic facilities. A portion of delivered power is provided through power purchase agreements, including 15 renewable energy agreements. In 2022, 39 percent of TVA's power supply was from nuclear; 22 percent from natural gas; 13 percent from coal; 8 percent from hydroelectric; 13 percent from non-renewable purchases; and 5 percent from renewable power purchase agreements. 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.

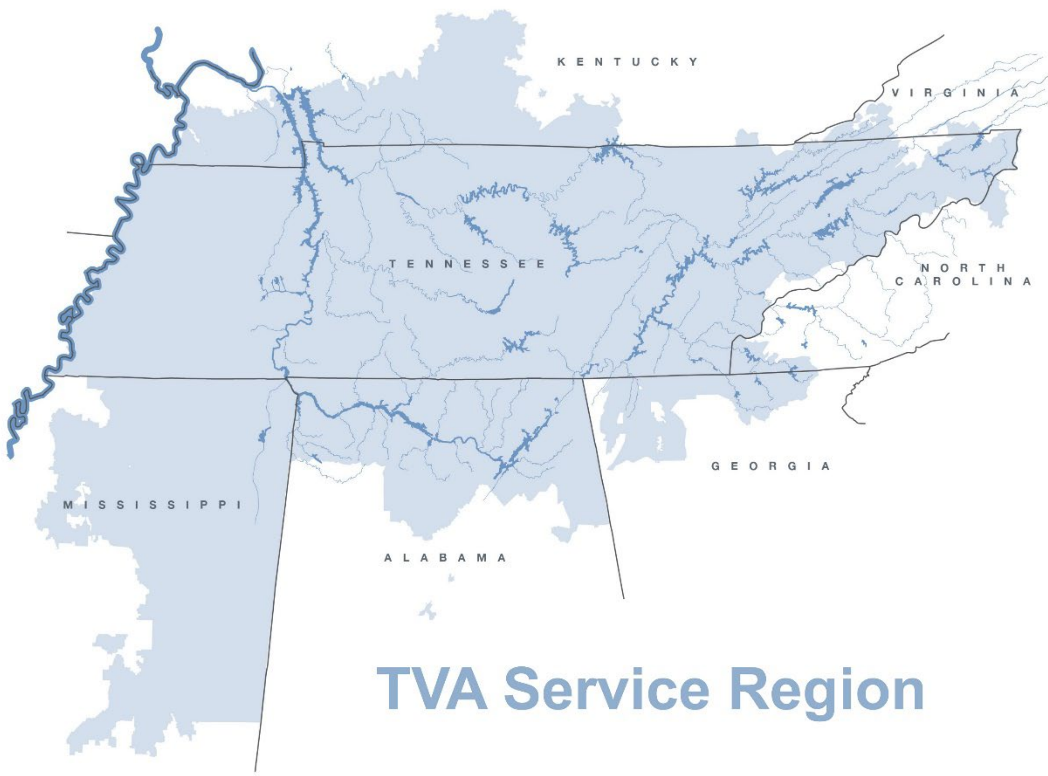

Figure 1. TVA Region

TVA is developing the next IRP to identify the most effective energy resource strategies that will meet TVA's mission and serve the people of the TVA region between now and 2050.

In 2019, TVA completed the current IRP and associated EIS. The recommended Target Power Supply Mix described in the 2019 IRP was formally approved by the TVA Board of Directors (Board) in August 2019 and has guided TVA energy resource decisions since then. In addition, the Board also directed TVA staff to monitor key signposts, such as changing market conditions, more stringent regulations, and technology advancements, and initiate the next IRP no later than 2024 or because of changes to these key signposts.

While the 2019 IRP has and continues to serve TVA well, changes in a number of key signposts warrant updating the IRP. These include increased load growth driven by residential in-migration to the TVA region, increased economic development, evolving regulatory requirements and stakeholder expectations, and changes to operating costs for both existing and emerging resource options. An updated IRP is needed to proactively establish a strong planning foundation for the 2030s and beyond and inform TVA's next long-range financial plan.

In the 2024 IRP, TVA intends to address strategies through 2050. Consistent with Section 113 of the Energy Policy Act of 1992, TVA employs a least-cost system planning program in developing its IRPs. This program considers multiple factors, including the demand for electricity, energy resource diversity, energy conservation and efficiency, renewable energy resources, flexibility, dispatchability, reliability, resiliency, costs, risks, environmental impacts and the unique attributes of different energy resources.

3 Purpose and Need

TVA develops its IRPs to provide direction on how to best meet future electricity demand by identifying the most effective energy resource strategies that will meet TVA's mission to serve the people of the TVA region to make life better.

Due to changes in several key signposts – such as demand for electricity, stakeholder expectations, regulatory requirements, operating costs for existing units, solar and wind costs, and emerging and developmental technologies–TVA is developing an IRP and associated EIS. For example, since the pandemic, there has been a substantial influx of people to the TVA region and increased economic development, resulting in load growth of about 3.5 percent over pre-pandemic levels. TVA is working to proactively address changing and anticipated conditions. When completed and approved by the Board, the 2024 IRP will replace the 2019 IRP.

The purpose of the IRP and EIS processes is to study how TVA could meet customer demand for electricity between now and 2050 across a variety of possible futures on a least-cost, system-wide basis while considering TVA's mission of service through energy, environmental stewardship and economic development.

An updated IRP is needed to proactively establish a strong planning foundation for the 2030s and beyond; inform TVA's long-range financial plan; and provide strategic direction for how TVA will continue to provide low-cost, reliable, and increasingly clean electricity to the 10 million residents of the TVA region.

4 Resource Planning Process

TVA employs a scenario planning approach when developing an IRP. Scenario planning provides an understanding of how the results of near-term and future decisions would change under different conditions over the planning horizon. The major steps in this approach include identifying the future need for power, developing scenarios (things outside of TVA control) and strategies (things TVA can control), determining potential supply-side and demand-side energy resource options, developing portfolios associated with the strategies, and evaluating strategies and portfolios.

Each strategy represents alternative business options that are evaluated against each scenario to create numerous portfolios, which are then evaluated to determine the most robust long-term plan. The number of alternative energy resource strategies and scenarios to be evaluated may differ from the 2019 IRP/EIS and what was presented in scoping and will be determined after the completion of scoping.

Uncertainties, scenarios, and strategies are being developed as a collaborative effort between TVA and the IRP Working Group (IRP-WG). Final uncertainties, scenarios, and strategies evaluated will be reflected in the draft IRP and EIS that TVA publishes for public review.

5 Environmental Review Process

NEPA requires federal agencies to consider and study the potential environmental consequences of proposed actions. Actions, in this context, can include new and continuing activities that are conducted, financed, assisted, regulated or approved by federal agencies, as well as new or revised plans, policies or procedures. The NEPA review process is intended to help federal agencies make decisions that are based on an understanding of the action's impacts and, if necessary, to take actions that protect, restore, and enhance the environment (40 Code of Federal Regulations [CFR] 1500.1(c)). NEPA also requires that federal agencies provide opportunities for public involvement in the decision-making process. For more information, visit www.nepa.gov.

TVA is initiating the preparation of a programmatic EIS to assess the environmental impacts of the proposed action. The EIS analyzes significant environmental impacts to the combined TVA power service area and the Tennessee River watershed (TVA region) that could result from the potential power supply mix studied in the IRP. The scope of the 2024 IRP EIS will include the cost and reliability of power, air quality analysis and the social cost of carbon, the availability and use of renewable and distributed energy resources, the availability and use of demand side management options, the effect of energy efficiency programs, and the relationship of the economy and environmental justice to all of these options. The IRP EIS will address the effects of power production on the environment, including climate change, the effects of climate change on the TVA region, and the waste and byproducts of TVA's power operations.

TVA is using the input from the scoping period, summarized below, in developing the draft IRP and EIS. Notification of the availability of the draft IRP and EIS will be distributed to interested individuals, groups, and federal, state, and local agencies for their review and comment. During the public comment period of the draft IRP and EIS, TVA plans to conduct public meetings throughout the TVA region. Following the public comment period, TVA will respond to the comments received on the draft IRP and EIS and incorporate any necessary changes into the final IRP and EIS. TVA will make a final decision regarding the proposed action after the final EIS and IRP are published.

The completed final IRP and EIS will be placed on TVA's website and notices of its availability will be distributed. TVA also will send the final IRP and EIS to the Environmental Protection Agency (EPA), which will publish a notice of its availability in the Federal Register. The Board will make the final decision on the IRP no sooner than 30 days after the publication of the Federal Register notice of the filing of the final EIS and IRP. The Board will consider the analyses in the EIS and IRP when it selects the resource plan to be implemented. TVA will then issue a Record of Decision, which will include (1) the decision; (2) the rationale for the decision; (3) alternatives that were considered; (4) the alternative that was considered environmentally preferable; and (5) associated mitigation measures and monitoring, and enforcement requirements.

TVA intends to publish the draft IRP and EIS in early spring 2024 and publish the final IRP and EIS during the summer of 2024.

5.1 Applicable Federal Laws and Regulations

In addition to Section 113 of the Energy Policy Act of 1992 , several other federal laws and regulations are relevant to TVA's integrated resource planning. Those that are specific to the natural, cultural, and socioeconomic resources potentially affected by the TVA power system are described below.

5.1.1 National Environmental Policy Act

The EIS will be prepared in accordance with the NEPA of 1969 (42 United States Code [U.S.C] §§ 4321 et seq.), regulations implementing NEPA promulgated by the Council on Environmental Quality (40 CFR Parts 1500 to 1508), and TVA NEPA procedures (40 CFR 1318). For major federal actions with significant environmental impacts, NEPA requires that an EIS be prepared. This process must include public involvement and analysis of reasonable alternatives to the proposed action.

According to the Council of Environmental Quality regulations, a programmatic EIS is appropriate when a decision involves a policy or program or a series of related actions by an agency over a broad geographic area. Due to the comprehensive nature of the IRP, this EIS meets that criterion. The environmental impacts of the alternative actions are, therefore, addressed at a regional level, with some extending to a national or global level. TVA will address the site-specific effects associated with specific projects that are proposed to implement the IRP in subsequent tiered environmental reviews.

5.1.2 Relevant Laws and Executive Orders

Several other laws and executive orders (EO) are relevant to the construction and operation of TVA's electric power system (Table 1). These laws and orders may affect the environmental consequences of an alternative plan, or measures needed during its implementation. Most of these laws also have associated implementing regulations. The EIS will describe the regulatory setting for each resource in more detail.

It is important for TVA to incorporate these changes in its long-term planning as the cost structure shifts for certain types of resources, as is evident in the Inflation Reduction Act of 2022 (IRA). The IRA creates incentives for solar, wind, storage, and other advanced technologies, but there also are challenges on the supply-side that need to be considered.

5.2 Environmental Resources to Be Considered in EIS

Based on discussions with both internal and external stakeholders, TVA anticipates that the scope of the IRP EIS will include the cost and reliability of power, air quality analysis and the social cost of carbon, the availability and use of renewable and distributed energy resources (DER), the use and availability of demand side management options, the effect of energy efficiency programs, and the relationship of the economy to all of these options. The IRP EIS will address the effects of power production on the environment, including climate change, the effects of climate change on the TVA region, and the waste and byproducts of TVA's power operations.

Based on internal and public scoping, identification of applicable laws, regulations, executive orders and policies, TVA identified the resource areas listed here as requiring analysis within the EIS:

- Air quality
- Climate and greenhouse gases
- Water resources
  - Groundwater
  - Water quality
  - Water supply
  - Aquatic life
- Land resources
  - Geology
  - Vegetation and wildlife
  - Endangered and threatened species
  - Wetlands
  - Parks, managed areas, and ecologically significant sites
  - Land use
  - Cultural resources
- Availability of renewable energy resources
- Solid and hazardous wastes
- Socioeconomics
- Environmental justice

The current status and, where applicable, recent trends in each of these resources will be described for the TVA region as a whole as well as for TVA's current generating facilities. The analysis of the potential environmental impacts of the alternative strategies will focus on system-wide changes in emissions of air pollutants, including greenhouse gases (GHGs); water use and consumption; fuel consumption, including coal combustion residuals and spent nuclear fuel production; employment and per capita income; and disproportionate impacts to minority and low-income populations. TVA anticipates that the environmental effects examined will primarily be those at a regional level with some extending to a national or global level. Because of their location-specific nature, TVA will describe the potential impacts to land resources by applying a land metric that is based on the land area required to construct and operate any new generating facilities.

Table 1. Relevant Laws and Executive Orders

Environmental Resource Area	Law / Executive Order
Water Quality	Clean Water Act
Groundwater	Safe Drinking Water Act Resource Conservation and Recovery Act
Air Quality	Clean Air Act
Wetlands and Waters	Clean Water Act Executive Order (EO) 11990 – Protection of Wetlands American Rescue Plan
Floodplains	EO 11988 – Floodplain Management
Endangered and Threatened Species	Endangered Species Act Migratory Bird Treaty Act Fish and Wildlife Coordination Act Bald and Golden Eagle Protection Act
Cultural Resources	National Historic Preservation Act Archaeological Resource Protection Act Native American Graves Protection and Repatriation Act
Environmental Justice	EO 12898 – Federal Actions to Address Environmental Justice in Minority and Low-Income Populations EO 14008 – Tackling the Climate Crisis at Home and Abroad EO 14096 – Revitalizing Our Nation's Commitment to Environmental Justice for All
Land Use	Farmland Protection Policy Act
Coal Mining	Surface Mining Control and Reclamation Act
Waste Management	Resource Conservation and Recovery Act Comprehensive Environmental Response, Compensation, and Liability Act Toxic Substances Control Act
Infrastructure Planning and Sustainability	Inflation Reduction Act Bipartisan Infrastructure Law EO 14057 – Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability

Because of its nature as a planning document, the IRP will not identify specific locations for new resource options. Site-specific environmental effects of new resource options will be addressed in later site-specific assessments tiered off this programmatic EIS. Due to the location- and facility-specific nature of the potential effects related to public and occupational health and safety, transportation and visual resources, these effects are not amenable to being addressed at a programmatic level and will be addressed in subsequent environmental analyses of individual actions taken to implement the 2024 IRP.

6 Public Outreach during Scoping Period

A key element of TVA's IRP process is to ensure active public involvement and direct engagement with a diverse group of stakeholders. On May 19, 2023, TVA published a NOI in the Federal Register announcing that it planned to prepare an EIS to address the potential environmental effects associated with the implementation of the updated

IRP (Appendix A). The NOI publication initiated a 45 -day public scoping period, which concluded on July 3, 2023. The NOI asked for suggestions or comments concerning the list of issues which should be addressed, including suggestions for how TVA can effectively reach and receive comments from environmental justice communities during the NEPA process.

The NOI included five scoping questions for consideration.

1. How do you think the demand for energy will change between now and 2050 in the TVA region?
2. Should the diversity of the current power generation mix (e.g., nuclear, coal, natural gas, hydroelectric, renewable resources) change? If so, how?
3. How should DER be considered in TVA planning?
4. (a) How should energy efficiency and demand response be considered in planning for future energy needs and (b) how can TVA directly affect electricity usage by consumers?
5. How will the resource decisions discussed above affect the reliability, dispatchability (ability to turn on or off energy resources), and cost of electricity? Are there other factors of risk to be considered?

Commenters' responses to these five scoping questions in the NOI are summarized in Section 7.4.

In addition to the NOI publication in the Federal Register, TVA provided notice and information about the next IRP on the TVA website www.tva.com/irp. TVA also issued a news release to more than 300 outlets, including local, state, national and trade sources, and requested public comments through social media channels (Appendix B). TVA also directly notified local and state government entities and federal agencies as well as numerous individuals and organizations.

6.1 TVA's Integrated Resource Plan and EIS Website

TVA is utilizing its existing corporate website as the primary platform for public outreach. The project website (www.tva.gov/irp) is intended to serve as the primary hub for distributing information to the public. During the public scoping period, the project website encouraged the public to submit scoping comments using an online form, via email to irp@tva.gov, or by mail to Kelly Baxter, NEPA Specialist. It also instructed those interested in future updates on the IRP and EIS to provide their email address to be added to the IRP mailing list.

During the public scoping period, TVA hosted two live public webinars (May 23 and June 7, 2023) to provide information about the IRP and EIS process and to allow the public to ask clarifying questions.

The purpose of the scoping period and webinars were to present TVA's project objectives and initial alternatives for input from the public and interested stakeholders. Copies of webinar materials are included in Appendix C, and recordings of the meetings are available at TVA's IRP website.

At each webinar, TVA staff described the process of developing the IRP and associated EIS and responded to questions from meeting attendees online. The May 23 webinar featured around 40 participants and 16 clarifying questions, while the June 7 webinar featured around 75 participants and 18 clarifying questions.

6.2 IRP Working Group

To gain additional input, TVA established an IRP Working Group (IRP-WG) to engage stakeholders more actively throughout the development of the IRP. The group consists of 24 external stakeholders representing a wide range of organizations.

There are eight stakeholders representing the interests of entities purchasing power from TVA, including:

- Local power companies (LPCs)
- Customer associations

There are 16 stakeholders representing other interests, including:

- Research and/or academic institutions
- Energy and/or environmental non-governmental organizations
- State or federal governments
- Community, sustainability, and/or other special interests

6.3 Other Forums for Engagement

TVA seeks customer and stakeholder input on an ongoing basis through forums such as:

- Federal Advisory Committees
- Quarterly TVA Board Listening Sessions
- Environmental Impact Studies
- Regional Field Teams

The 2024 IRP process will leverage both past effective engagement venues as well as input from several additional avenues and enhanced stakeholder engagement mechanisms such as:

- Periodic Informational Webinars
- Dedicated IRP Public Website
- Leveraging outputs from Valley Vision 2035, Valley Pathways Study, and Utility of the Future Information Exchange
- Regional Field Teams

TVA aims to apply an environmental justice focus to all engagements with the objective of advancing improvements in reaching and involving environmental justice populations. Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Further, TVA maintains an IRP contact list of individual stakeholders that is regularly updated with contact information from those who submitted their name for future IRP updates, webinar registrations on the IRP website, and attendance at webinars and public meetings.

7 Summary of Public Scoping Comments

During the public scoping period, TVA received a total of 43 official comments between the online portal, email, and mail-in options. Comments were primarily received from states within the TVA power service area, which accounted for approximately 87 percent of responses. Comments were also received from four states outside of the TVA region and Washington, D.C.

Of the 43 submissions, 22 comments were received from individuals, 9 from businesses, 10 from civic or non-governmental organizations, and 2 from government agencies.

TVA also received several hundred statements from the public in response to TVA IRP social media pages during the scoping period. These statements were not formally submitted as comments and are therefore not included in this analysis.

Comment submissions are included in Appendix D. Section 7.1 and subsequent bulleted sections represent comment themes and summaries of comments received during the public scoping period.

7.1 Integrated Resource Planning

7.1.1 The Planning Process

General

- Preference for a domestic energy supply chain.
- Effort should be put into cyber security.
- The timeline on renewables should be faster.
- Management objectives should align with consumer interests and lowest total power

cost by including the costs of fuel and purchased power into performance goals. Ensure no contradictions between overall-system and site-specific planning exercises.
- The IRP should align with federal policies, programs and investments.
- TVA must follow through on its 2019 clean energy commitments to inform the 2024 IRP.

Transparency
- Engagement meetings should provide information in a non-technical manner.
- Share modeling inputs and assumptions with stakeholders to ensure a robust end-product; make a detailed technical appendix available.
- Provide the full suite of data for each generation technology, including data on its existing solar, wind and storage capacity.
- The process for incorporating comments during this scoping period should be transparent and shared with stakeholders.
- Be transparent about scheduled capacity additions, retirements and which resources will supply the necessary emission reductions to meet climate goals.
- Define what utilities and capacities TVA owns outright and which are from other sources and agreements, including ownership of renewable attributes (i.e., credits sold in Green Invest program).
- Address the role that nuclear energy will play in the energy transition.
- Address how TVA will incorporate responsible environmental stewardship in the management of TVA land and resources.

Engagement
- TVA should incorporate robust public participation and stakeholder engagement, ensuring that hearings, forums and working group meetings are open to the public and streamed live, and meetings are held throughout the region. Summaries and materials should be provided.
- A third-party or independent entity should be in charge of community engagement, facilitation and public comments.
- The value of non-technical expert testimony and lived experience should be considered.
- Conduct non-simultaneous public comment periods for optimal public engagement.
- Include alternative strategies from stakeholders.
- Consider comments on 2019 IRP.
- Stakeholders should be able to intervene in the IRP process. TVA should provide a way for stakeholders to submit comments and information requests after scoping and during the early planning period (until the publication of the draft IRP). Also recommend TVA's Board of Directors hear directly from stakeholders.
- Partner with community organizations in the development of the IRP to reach traditionally underserved and overburdened communities and include representatives in stakeholder and public engagement.
- Work directly with communities and local providers to ensure future resource planning is consistent with local infrastructure capacity.
- Integrate the work of the newly announced Tennessee Nuclear Energy Advisory Council.
- Early collaboration between local and federal solar permitting agencies, developers, and state and federal wildlife agencies should be established.

Information Submitted
Public comment submittals included several reports, proposals and presentations for consideration in forming the IRP and EIS. They included:

- A 20-page proposal for system-wide decarbonization of coal and natural gas power plants using a storage-first approach. (Skibo Energy)
- A Brattle Group presentation entitled "Real Reliability: The Value of Virtual Power." (Tennessee Solar Energy Industries Association)
- A 48-page report entitled "TVA's Clean Energy Future: Charting a course to decarbonization in the Tennessee Valley" (Center for Biological Diversity)

- A petition for 100 percent clean energy at TVA with 6,658 undersigners (Center for Biological Diversity)
- An extensive analysis of Winter Storm Elliott (Southern Renewable Energy Association)
- Information surrounding energy justice (Vote Solar)
- Plans to conduct independent power system planning studies (Tennessee Valley Energy Consumers Group)
- A 36-page Applied Economics Clinic report (Southern Environmental Law Center et al.)

Analyses and Modeling

- Ensure modeling data and methodologies are reflective of current market offerings.
- Expand generation technology forecasts.
- Include advanced generation technologies for analysis and proper modeling methodologies.
- Alternatives consistent with TVA's Adaptation Plan should be considered.
- How will climate change impacts affect operations of all alternatives considered.
- Consider offering as much solar and storage as possible in the Preferred Alternative.
- The percentage of generation that LPCs can provide, and the value of storage systems should be determined in modeling potential scenarios to reach carbon-free goals.
- Third-party modeling would allow for a robust analysis and the opportunity to maximize the implementation of demand-side management (DSM) programs.

Climate Inputs

- Use climate projections specific to the study area, not national or global projections.
- Include the effects of extreme weather and lessons learned in IRP and analyses.
- Climate change impacts are projected to be exacerbated.
- Consider how increased heavy precipitation and flooding may affect appropriate siting and elevation of infrastructure.
- Incorporate net-zero climate targets and modeling limitations into IRP.

Economic Inputs

- Use the latest forecasts for resource costs.
- Renewable power projects are critical economic tools that could support TVA and LPCs needs to remain relevant and competitive with regard to the recruitment, retention and expansion of businesses and industries throughout the TVA region.
- Include resources from Power Purchase Agreements as well as selectable TVA-built resources for solar and storage in modeling and analysis, where the price includes TVA's elective pay incentive.
- Conduct an all-resource request for proposals that could be made available today under current market prices.

Inflation Reduction Act Considerations

- Incorporate all financial incentives through IRA programs, including tax credits, into analysis and energy modeling.
- Explain plans to maximize IRA investment and benefits in the service area.
- Use the Department of Energy estimates on the impacts of the IRA on clean energy and GHG emissions.
- Incorporate more new and emerging technologies that are more economically advantageous as a result of IRA to include carbon sequestration, hydrogen, etc.
- Consider grants and other funding sources available through the IRA for projects such as transmission and generation resources to displace fossil fuel resources, either through determining scenarios or sensitivities around the costs of these resources.

7.1.2 Demand, Resilience, and Reliability

- Alternative energy sources need to be improved and become more efficient and reliable before they are used as a baseload power source instead of supplemental sources.
- Decrease power outages; increase power reliability.
- Concerns about the future reliability of the power grid.

- During winter blackouts, the renewables were reliable.
- Accessing generation resources outside of TVA's geographic region may be a more cost-effective way to meet generation reliability requirements.
- Reassess reliability and resilience of clean energy resources relative to fossil fuels.
- The 2024 IRP should include a modern reliability analysis.
- DER and other energy solutions will foster local energy control and resilience.
- Caution at curbing GHGs until TVA can ensure affordability, security, reliability and survivability of energy production.

7.1.3 Decarbonization

- Operations/plans should align with United States decarbonization goals and include targets.
- The necessary technologies to decarbonize electrical generation are available.
- Consider development of additional utility-scale renewable energy projects and investments in infrastructure for the broader use of renewables.
- Shift away from fossil fuel energy that harms marginalized, vulnerable communities, as well as species.
- Decarbonization alternatives and combinations must address how they meet customer energy needs.
- Preference for carbon neutral, clean, renewable energy generation and DER.
- Continue to explore coal plant retirements and replacement at sites with solar, gas or other renewable alternatives and clean energy technology, including hydrogen fuel and carbon capture technology.
- Replacing coal plants with a clean energy could save ratepayers.
- Prefer nuclear to replace retiring facilities.
- Proposed new generation should focus less on new gas, more on solar and storage.
- Focus on natural gas, nuclear, and hydropower to cover baseload power needs.

Emissions

- Compare and contrast emissions of all potential new generation sources against existing infrastructure.
- Will need to employ complicated reduction

  methods to meet proposed emissions limits.
- Carbon capture will be difficult given the sedimentary strata under TVA service area.
- The transition of coal plants to natural gas facilities needs to take potential GHG, methane and other air pollutants into consideration.

Regulations

- Decarbonization fulfills TVA's statutory mandate, congressional mandates and presidential directives.
- IRP should reflect EO 14057 (Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability).
- TVA should not sacrifice energy production to meet emissions standards above what the law requires.
- Use the U.S. Treasury Department's Final Rule on Section 45Q Credit Regulations to provide clarity on how to use carbon sequestration credits.

7.1.4 Environmental Justice (EJ)

- Devote a chapter of the IRP to TVA's definition, approach and learning on how equity applies to the IRP process. Include equity in each chapter of the IRP.
- IRP should incorporate energy justice.
- IRP should look to reduce impacts on overburdened and vulnerable communities.
- Address the Justice40 initiative in the IRP, including guidelines to ensure investments benefit disadvantaged communities.
- Integrate data supporting the identification of EJ communities (energy burden, vulnerability to extreme weather events) and utilize mapping tools to identify disadvantaged communities, tribal land and other EJ communities (Climate and Economic Justice Screening Tool, EJScreen).

- Using current sites of coal and gas to place new reactors allows jobs to stay in small towns through retraining of the workforce.
- Farmland costs, rental rates may increase as land is converted to solar energy production.

Engagement

- Engage and collaborate with underserved, overburdened communities to identify and address adverse conditions and ensure they do not face additional disproportionate burdens under the IRP.
- Community-based and energy justice organizations should be on the IRP-WG.
- A Community Benefits Committee could advise the IRP team on how modeling and decisions impact underserved communities.
- Proactively engage with underserved communities, creating economic opportunity, and advancing urban equitable development.
- Work directly in rural communities to support and prioritize workforce and economic development opportunities, as closing or transition of existing coal plants may disproportionately impact rural economies.

7.1.5 Planning Scenarios and Strategies

Scenarios

- Scenarios should meet emissions goals laid out by the Administration, TVA's commitments and the U.S. 2030 national reduction target in the Paris Agreement.
- Include at least one scenario in compliance with the U.S. Environmental Protection Agency's (EPA) proposed GHG regulations on new and existing coal and gas power plants.
- Include at least one scenario modeling coal retirements to determine the need to adjust current planning assumptions.
- Include at least one scenario where proposed gas plants are a selectable resource, to allow the model to choose replacement generation resources for coal retirements.
- Include at least one scenario that achieves at or near 100 percent decarbonization of TVA's entire generation fleet by 2035.
- Model various electrification scenarios with different load growth projections.
- Model hydrogen electrolysis load growth in sensitivities and scenarios.
- Faster and further scenarios should be included to take advantage of new opportunities.
- Consider impacts on rural communities in different conditions over the planning horizon.

Strategies

- At least one strategy model should be based on meeting power needs through a maximum use of distributed carbon-free resources.
- Consider areas of business process improvement and support a robust stakeholder process to resolve current challenges in the near term.
- No arbitrary caps on new renewable resources, either annual or cumulative deployment.
- Include virtual power plants in energy strategies as they can contribute to reliability, resilience, facilitate electrification, and increase equity and sustainability.
- System-wide decarbonization through a storage first approach, turning coal and natural gas plants into energy storage facilities (i.e., grid-scale battery equivalents) and enabling renewable sources to be added to the power grid.
- Marshal a new set of resources, recognize new priorities and devise new policies to serve residents and be effective.

7.2 Energy Resource Options

7.2.1 General

- Power programs should meet community interests and technical needs.
- Load management could be improved by reusing resources for new generation.
- Repurpose old fossil generation properties, industrial sites, and brownfields for energy development. These sites have infrastructure to connect new generation to the grid.

- In favor of natural gas and solar combo.
- Consider the lifespan of renewables as well as their disposal.
- Model energy characteristics.
- Consider a new regional transmission organization or join an existing market.
- Invest in on-site renewables to help root companies in TVA territory; consider this flexibility an investment in economic development.
- Consider changes that reduce land-use impacts and increase community resilience.

7.2.2 Local Power Companies (LPCs) and Programs

- There is interest in flexibility for renewable energy allocation, pooling and increasing caps to increase options for the integration of renewable resources by LPCs.
- Open up policies on distribution-level projects, including LPC flexibility and net-metered rooftop solar.
- Consider the energy and capacity impacts and expansion of LPC self-generation, the Flexibility Generation program, and other options for direct to customer DER programs.
- Evaluate opportunities to expand the Dispersed Power Production Program or similar programs that enable electricity production from renewable sources.
- Include strong distributed generation programs, which enhance grid reliability and allow for more rapid deployment of renewable generation.

7.2.3 Infrastructure

- Direct more resources to grid and transmission infrastructure.
- Proposed new generation should focus on building clean energy infrastructure.
- Create more infrastructure (lines and substations) and upgrade utility infrastructure to distribute, carry, and keep up with increased loading.
- Modernize existing assets and co-locate types of generation across TVA footprint.
- Vulnerability exists in the bulk power system.

Transmission

- Improve transmission planning and integrate transmission expansion planning with generation planning.
- Consider proactive transmission planning to unlock renewables in the highest-value areas and build IRP models that consider lowest-cost transmission planning with no arbitrary caps on renewable expansion based on current transmission constraints.
- Study and invest in greater interregional transmission capacity to allow greater sharing of energy across regions during periods of grid challenges, such as extreme weather.

7.2.4 Solar and Wind

- Solar and wind energy are unreliable, and output will not meet daily needs.
- In favor of more wind and solar farms.
- Add solar and wind capacity to 500 kilovolt substations, using available space.
- Existing transmission towers could be "vertical assets" by retrofitting structures with solar panels or small wind turbines.

Solar

- Privately owned rooftop solar could be viable solutions to energy needs and should be encouraged with other onsite solar placement that reduce transmission lines and other infrastructure needs.
- Consider programs or incentives to support distributed solar in urban environments.
- Solar canopies over parking lots could provide protection and self-generation for parking lot needs (electric vehicle charging, lights, etc.).
- Evaluate solar siting on built infrastructure, such as parking lots, rooftops and other distributed solar on already developed land, brownfields or former landfills.
- In favor of LPC community solar projects.
- Concerns over the land needs of solar farms.
- Market opportunities exist for landowners with solar energy production leases.

- Concern for ability of solar to meet future energy demand growth.
- Solar and stored energy is reliable as seen from Winter Storm Elliot.
- Consider the stability of transmission grids in development of solar energy infrastructure.

Wind

- Explore wind energy resources both within the TVA region and externally.
- There should be no siting industrial-scale wind as Tennessee is a "low commercial wind" state.
- Solutions that adequately address the loss of wildlife from wind power do not exist.

7.2.5 Natural Gas

- Concerns exist regarding new and aging natural gas pipeline infrastructure.
- Natural gas additions will add to TVA's climate impact and increase the possibility of leaks, potential blowouts.
- Opposed to new gas generation facilities.
- In favor of retiring natural gas and investing in renewables to reduce pollution.
- No replacement of the existing coal units with natural gas until after IRP completion.
- Proposed and under construction gas plants should be considered potential capacity additions.
- Previously expressed preference for natural gas should not be built into future plans.
- No additional gas plants until after completion of the next IRP.

7.2.6 Nuclear

- Resources have been wasted on projects that could be finished instead of starting new ones (Bellafonte, Phipps Bend, etc.).
- Nuclear power offers the best path forward in meeting carbon emission goals while providing reliable electricity generation.
- People consider large nuclear reactors a risk.
- Knowledge, experience and skills gained from recently completed nuclear power plants could be put to use.
- Nuclear can meet energy load demands where wind, solar and hydro cannot.
- Nuclear will enhance grid reliability, provide jobs, contribute to the local tax base.
- In support of efforts with dependable, clean, safe and affordable nuclear power.

Small Modular Reactors (SMRs)

- SMRs in the power grid will help meet residential and industrial growth energy demands and reduce overall system costs.
- SMRs will ease grid decarbonization.
- Having new SMRs online to replace the existing fleet will ensure no loss of power and increased nuclear capacity.
- SMRs will be a clean alternative to coal.
- SMR expansion should be the central, critical part of the energy portfolio as they are buildable and reliable.
- Consideration should be given to a detailed evaluation of SMRs and their use.
- In favor of SMRs dispersed throughout the TVA service area; dispersal could help protect against cyber security attacks.
- Multiple SMRs with standard designs allow for cost savings and leave room for new technologies.
- Use infrastructure at existing nuclear plants to co-locate SMRs.

7.2.7 Energy Storage

- Ethical concerns over lithium storage.
- Treat Battery Energy Storage System as a resource capacity and reliability asset.
- Consider the role of storage in plans to reach 10,000 MW of solar by 2035.
- Model current and forward-looking storage technologies and include benefits to the grid.
- Renewables plus storage can strengthen the grid and provide more reliable energy.

7.2.8 Other

- Evaluate feasibility of implementing policies that promote electrification while minimizing additional capacity requirements.

- Renewable energy and storage is a known technology with a lower risk of failure and stranded assets, as opposed to hydrogen generation.
- Modernize hydropower generation plants to meet potential energy gains with more efficient turbines and/or converting them to hydrogen-based generation facilities.
- Upgrade existing hydropower facilities for additional generation capacity to replace older, less efficient assets.
- ***Note**: Comments on DER are included in scoping questions (Section 7.4).*

7.3 Environmental Impact Statement

7.3.1 General/Scope

- Exhaust from coal plants impacts water and air quality.
- Address the effects of the totality of TVA's operations resulting from IRP implementation.
- Best scientific evidence should be used to calculate the social cost of carbon, methane leakage and species impacts.
- Do not solely rely on the Pathways Study as a basis for the EIS.
- Incorporate information based on proposed regulations and guidance under the IRA.
- Account for the local environmental impacts of various energy resources.

7.3.2 Summary of Submitted Alternatives, Information, and Analyses

In accordance with updated NEPA regulations (40 CFR 1502.17), public comments received during the scoping process that identified alternatives, information and analyses are summarized here. A further summary will be included in the EIS.

Alternatives

- Compare the environmental impacts of reliance on fossil fuel resources to those associated with clean energy alternatives.
- Outline the likely environmental outcomes under the different alternatives that include a path to zero emissions.

7.3.3 Natural Resources

- Consider the impact resource planning and use has on cultural and natural resources.
- Consider the impact of land use change on biodiversity, archeological resources and other natural resources.
- Account for utility-scale solar development impacts to wildlife, habitat, water resources and recreational uses.
- Determine how renewable energy infrastructure development can impact wildlife and habitat.
- New gas facilities can impact wildlife.

Air Quality

- All emissions from power plants and their associated upstream impacts of acquisition and delivery must be accounted for.
- Use the best available social costs of GHG estimates from a proposed action and its alternatives.
- EPA's proposed regulations limiting GHG emissions from fossil fueled electrical generation should be clearly explained and acknowledged in the EIS.

Water Quality

- Consider the potential benefits to state waters when developing strategies for energy portfolios.
- Continue to explore the nexus of water and energy.
- Consider the potential impacts of water withdrawals on public water systems and resources.

Land Use

- Solar may require a large amount of land that disrupts farmland or forests.
- Solar energy production siting and placement should prioritize non-agricultural lands and apply least-conflict efforts.

- The EIS should account for potential irreversible loss of agricultural land.
- Land should be protected from conversion and fragmentation through evaluating alternative sites and design considerations.
- Make clear the potential impacts of energy expansion on public lands such as parks, managed areas and ecologically significant sites, as well as impacts of changing land uses such as retirements.
- Not in support of the conversion of existing TVA-held public wildlife habitat lands or natural areas for energy development.

7.3.4 Human Impacts

Visual Resources

- Current coal plant towers are an eye sore.

Human Health

- New gas facilities will negatively affect human health.
- GHG reductions can have health benefits.

Environmental Justice

- Section 3a of EO 14096 (Revitalizing Our Nation's Commitment to Environmental Justice for All) provides analytic direction for the EIS.
- Consider environmental impact and workforce and economic development in rural communities.
- Recognize how issues such as water quality, air quality, waste generation and disposal, land use, and socioeconomic impacts may differ in rural areas.

7.4 Commenters' Responses to Scoping Questions in TVA's Notice of Intent

As described above in Section 5, TVA asked scoping participants to respond to five questions that the IRP will begin to answer. Few scoping participants responded directly to these questions. Following are the questions and responses, both those answered directly and those that were answered in general comments but found to be relevant to the question(s).

(1) How do you think the demand for energy will change between now and 2050 in the TVA region?

- Population growth and increased use of electric products will heavily increase energy demand.
- Power demand is likely to grow, as will seasonal peaks.
- Renewable energy demand is growing and it is now cost competitive.
- The region will need to consider growing energy demands, load requirements and industrial growth in its generation strategy.
- Increased electrification and improvements in energy storage will change energy use.
- New buildings and industrial growth are stressing the electrical, which currently cannot keep up.

(2) Should the diversity of the current power generation mix (e.g., nuclear, coal, natural gas, hydroelectric, renewable resources) change? If so, how?

- Support for utilizing and expanding production of all domestic energy resources to increase energy resiliency.
- The future resource mix should go toward decarbonization and protect ratepayers.
- A variety of renewable energy resources will be needed to accomplish affordable and reliable energy production.
- There should be a commitment to no new fossil fuel plants and replacing them with efficient renewable energy and storage.
- Future efforts should focus on distributed, clean energy power production and storage.
- Geographically diverse resources should be evaluated as a way to increase resilience and reliability of the electric resource mix.
- Support for nuclear energy as a clean, safe and affordable source, and expansion of nuclear energy capabilities.
- Support for the expansion of natural gas infrastructure as it provides an opportunity to

diversify with fewer GHG emissions, is cost-effective and can meet potential needs.
- Support for using clean coal technology.
- Encourage the exploration methane capture opportunities through partnership with governments, utilities and industry.
- Challenges associated with technology dependence and electrification will need to be met with reliable, decentralized, renewable energy systems and grid modernization.

(3) How should DER be considered in TVA planning?

- DER can play a significant role in TVA's energy future and should be included at all levels, broadening the ability of customers to self-generate and store energy.
- Up-to-date cost and assumptions for DER technologies should be used in analysis.
- DER placement should prioritize lands not suitable for agriculture to lower impact.
- DER is key to energy justice, and investment offers financial risk mitigations benefits.
- Continue to implement and expand renewable energy and DER offerings, such as virtual power plants programs, expansion of the Generation Flexibility program, and other DER as critical tools for addressing grid reliability, affordability, security and sustainability.
- DER can bypass transmission complications.
- DER contributes to resilience by increasing local generation capabilities and DER loads can be purposefully shaped to provide maximum grid and/or ratepayer value.

(4a) How should energy efficiency and demand response be considered in planning for future energy needs?

- Continue to implement and expand comprehensive energy conservation, DSM, and energy efficiency (EE) measures, programs and technologies that will reduce energy demand.
- Include distributed resources from LPCs along with increases in EE and other demand reduction programs (DER).
- Examine demand response solutions for mitigating impacts of crypto-mining facilities and other large non-essential energy users.
- Consider vehicle-to-grid technology for demand-response services and other grid benefits.

(4b) How can TVA directly affect electricity usage by consumers?

- Deepen commitment to reducing low-income energy household burdens through increased access to EE measures and DSM programs via collaboration with local governments and leveraging relationships with community-based organizations.
- Encourage Direct Serve customers with space to generate power for increased resiliency, opportunities for self-performing EE programs and increased investment in the TVA region.

(5) How will the resource decisions discussed above affect the reliability, dispatchability (ability to turn on or off energy resources), and cost of electricity? Are there other factors of risk to be considered?

- Proactive transmission planning and upgrading electric grid infrastructure will ensure affordability, security, reliability and survivability for end consumers.
- The 2024 IRP should consider EE and clean energy tax incentives and rebates through the IRA in its load forecast, and ensure these incentives are optimized to decrease the renewable costs and expand the deployment of solar and storage.
- Other foreseeable costs, taxes, regulations and subsidies for renewable energy and other sources should be forecasts to ensure TVA is fulfilling their statutory least-cost mandate.
- Evaluate how distribution resource planning and DER can support electrification.

- The goal of zero carbon emissions by 2050 is economically challenging and may increase costs for rate- and taxpayers. There should be more timeline flexibility.
- TVA should consider increasing speed of solar deployment to support long-term goals; the shift of the risk profile from TVA to the LPC and developers; and the reduction of effort in avoiding interconnection and in-building large network upgrades.
- Intermittent power sources will require storage and could be costly.
- Climate-related risks could cost customers with outages, capacity disruptions, and infrastructure damage.

Potential Mitigation Measures
TVA's siting processes for generation and transmission facilities, as well as practices for modifying these facilities, are designed to avoid and/or minimize potential adverse environmental impacts. Potential impacts also are reduced through pollution prevention measures and environmental controls such as air pollution control systems, wastewater treatment systems and thermal generating plant cooling systems. Other potentially adverse impacts can be mitigated by measures such as compensatory wetlands mitigation, payments to in -lieu stream mitigation programs and related conservation initiatives, enhanced management of other properties, documentation and recovery of cultural resources, and infrastructure improvement assistance to local communities. However, these mitigation measures would be considered and implemented during site specific reviews of future generation or transmission facilities or modifications to existing facilities in a tiered NEPA analysis.

During scoping, commenters suggested the following in regard to mitigation:

- The costs of mitigating greenhouse gas emissions from coal and gas plants, and increasing fuel cost volatility for gas plants, should be accounted for.
- Demand-response solutions should be examined for mitigating the harmful impacts of crypto-mining facilities and other large non-essential energy users.
- Partnership with other power generation and distribution experts should be considered in drafting a plan that reduces reliance on fossil fuels for power generation and mitigates greenhouse gas emissions.
- Natural gas plant designs should consider increased carbon capture and hydrogen fuel blending technology incorporation as a means of mitigating emissions and complying with future climate change regulations.
- Consider opportunities to mitigate the possible exacerbation of climate change impacts from possible alternatives.
- Impacts on water resources may be mitigated by using recycled greywater and prioritizing lower-impact capacity additions.

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TVA

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Appendix A – Federal Register Notice of Intent

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University Law School, Frederick Lawrence Student Conference Center, 2023 G St. NW, 2nd Floor, Washington, DC. Acting Legal Adviser Richard C. Visek will chair the meeting, which will be open to the public up to the capacity of the meeting room. The meeting will include discussions on international law topics, including how non-intervention applies in cyberspace and developments with Advisory Opinions at the International Court of Justice.

Members of the public who wish to attend should contact the Office of the Legal Adviser by May 26 at *rangchitm@state.gov* or 202–485–6590 and provide their name, professional affiliation (if any), email address, and phone number. Priority for in-person seating will be given to members of the Advisory Committee, and remaining seating will be reserved based upon when persons contact the Office of the Legal Adviser. A more detailed agenda will be available to registered participants in advance of the meeting. Attendees who require reasonable accommodation should make their requests by May 26. Requests received after that date will be considered but might not be possible to accommodate.

Tara M. Rangchi,

Executive Director, Advisory Committee on International Law, Department of State.

[FR Doc. 2023–10736 Filed 5–18–23; 8:45 am]

BILLING CODE 4710–08–P

DEPARTMENT OF STATE

[Public Notice: 12076]

Proposal To Extend the Cultural Property Agreement Between the United States and Bulgaria

SUMMARY: Proposal to extend and amend the *Memorandum of Understanding Between the Government of the United States of America and the Government of the Republic of Bulgaria Concerning the Imposition of Import Restrictions on Categories of Archaeological Material and Ethnological Material of the Republic of Bulgaria.*

FOR FURTHER INFORMATION CONTACT: Chelsea Freeland, Cultural Heritage Center, Bureau of Educational and Cultural Affairs: (202) 714–8403; *culprop@state.gov;* include ''Bulgaria'' in the subject line.

SUPPLEMENTARY INFORMATION: Pursuant to the authority vested in the Assistant Secretary of State for Educational and Cultural Affairs, and pursuant to 19 U.S.C. 2602(f)(1), an extension and amendment of the *Memorandum of Understanding Between the Government of the United States of America and the Government of the Republic of Bulgaria Concerning the Imposition of Import Restrictions on Categories of Archaeological Material and Ethnological Material of the Republic of Bulgaria* is hereby proposed.

A copy of the Memorandum of Understanding, the Designated List of categories of material restricted from import into the United States and related information can be found at the Cultural Heritage Center website: *http://culturalheritage.state.gov.*

Allison R. Davis Lehmann,

Executive Director, Cultural Property Advisory Committee, Bureau of Educational and Cultural Affairs, Department of State.

[FR Doc. 2023–10768 Filed 5–18–23; 8:45 am]

BILLING CODE 4710–05–P

DEPARTMENT OF STATE

[Public Notice: 12082]

U.S. Advisory Commission on Public Diplomacy; Notice of Meeting

The U.S. Advisory Commission on Public Diplomacy (ACPD) will hold a virtual public meeting on Wednesday, June 14, 2023, from 2:00 p.m. until 3:15 p.m. ET focusing on the ''Use of Artificial Intelligence in Public Diplomacy.'' During the meeting, a distinguished panel of experts will examine the use of AI tools in support of public diplomacy initiatives for a global community of PD practitioners, scholars, and policymakers.

This meeting is open to the public, including the media and members and staff of governmental and non-governmental organizations. To obtain the Zoom conference link and password, please register here: *https://statedept.zoomgov.com/webinar/register/WN_4E4sqpmuS-6A0G-UUo7gxw.* To request reasonable accommodation, please email ACPD Program Assistant Kristy Zamary at *ZamaryKK@state.gov.* Please send any request for reasonable accommodation no later than Monday, May 29, 2023. Requests received after that date will be considered but might not be possible to fulfill.

Since 1948, the ACPD has been charged with appraising activities intended to understand, inform, and influence foreign publics and to increase the understanding of, and support for, these same activities. The ACPD conducts research that provides honest assessments of public diplomacy efforts, and disseminates findings through reports, white papers, and other publications. It also holds public symposiums that generate informed discussions on public diplomacy issues and events. The Commission reports to the President, Secretary of State, and Congress and is supported by the Office of the Under Secretary of State for Public Diplomacy and Public Affairs.

For more information on the U.S. Advisory Commission on Public Diplomacy, please visit *https://www.state.gov/bureaus-offices/under-secretary-for-public-diplomacy-and-public-affairs/united-states-advisory-commission-on-public-diplomacy/,* or contact Executive Director Vivian S. Walker at *WalkerVS@state.gov* or Senior Advisor Deneyse Kirkpatrick at *kirkpatrickda2@state.gov.*

Authority: 22 U.S.C. 2651a, 22 U.S.C. 1469, 5 U.S.C. 1001 *et seq.,* and 41 CFR 102–3.150.

Vivian S. Walker,

Executive Director, U.S. Advisory Commission on Public Diplomacy, Department of State.

[FR Doc. 2023–10714 Filed 5–18–23; 8:45 am]

BILLING CODE 4710–45–P

TENNESSEE VALLEY AUTHORITY

Integrated Resource Plan and Environmental Impact Statement

AGENCY: Tennessee Valley Authority.

ACTION: Notice of intent.

SUMMARY: The Tennessee Valley Authority (TVA) is conducting a study of its energy resources. The Integrated Resource Plan (IRP) is a comprehensive study of how TVA will meet the demand for electricity in its service territory. TVA's most recent IRP was adopted by the TVA Board in 2019. As part of this new study, TVA will prepare a programmatic Environmental Impact Statement (EIS) to assess the impacts associated with the implementation of the next IRP. The EIS analyzes significant environmental impacts to the combined TVA power service area and the Tennessee River watershed (TVA region) that could result from the targeted power supply mix studied in the IRP. TVA will use the EIS process to elicit and prioritize the values and concerns of stakeholders; identify issues, trends, events, and tradeoffs affecting TVA's policies; formulate, evaluate, and compare alternative portfolios of energy resource options; provide opportunities for public review and comment; and ensure that TVA's evaluation of alternative energy resource strategies reflects a full range of stakeholder input. Public comment is invited concerning both the scope of the EIS and environmental issues that

should be addressed as a part of this EIS.

DATES: Comments must be postmarked, emailed, or submitted online no later than July 3, 2023. To facilitate the scoping process, TVA will hold public scoping meetings; see *https://www.tva.gov/IRP* for more information on the meetings.

ADDRESSES: Written comments should be sent to Kelly Baxter, NEPA Specialist, 400 West Summit Hill Drive, WT 11B, Knoxville, TN 37902–1499. Comments may also be submitted online at *https://www.tva.gov/IRP* or by email at *IRP@tva.gov.*

FOR FURTHER INFORMATION CONTACT: Kelly Baxter, 865–632–2444, *IRP@tva.gov.*

SUPPLEMENTARY INFORMATION: This notice is provided in accordance with the Council on Environmental Quality's Regulations (40 CFR parts 1500 to 1508) and TVA's procedures for implementing National Environmental Policy Act (NEPA). TVA is an agency and instrumentality of the United States, established by an act of Congress in 1933, to foster the social and economic welfare of the people of the TVA region and to promote the proper use and conservation of the region's natural resources. One component of this mission is the generation, transmission, and sale of reliable and affordable electric energy.

TVA Power System

TVA operates the nation's largest public power system, providing electricity to about 10 million people in an 80,000-square mile area comprised of most of Tennessee and parts of Virginia, North Carolina, Georgia, Alabama, Mississippi, and Kentucky. It provides wholesale power to 153 independent local power companies and 58 directly served large industries and federal facilities. The TVA Act requires the TVA power system to be self-supporting and operated on a nonprofit basis and directs TVA to sell power at rates as low as are feasible.

Dependable generating capability on the TVA power system is approximately 38,000 megawatts. TVA generates most of the power it distributes with three nuclear plants, five coal-fired plants, nine simple-cycle combustion turbine plants, eight combined-cycle combustion turbine plants, 29 hydroelectric dams, a pumped-storage facility, a diesel-fired facility, and 13 solar photovoltaic facilities. A portion of delivered power is provided through power purchase agreements, including 15 renewable energy agreements. In 2022, 39 percent of TVA's power supply was from nuclear; 22 percent from natural gas; 13 percent from coal; eight percent from hydroelectric; 13 percent from non-renewable purchases; and five percent from renewable power purchase agreements. 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.

Resource Planning

TVA develops an Integrated Resource Plan to identify the most effective energy resource strategies that will meet TVA's mission and serve the people of the region. In this IRP, TVA intends to address strategies through 2050. Consistent with Section 113 of the Energy Policy Act of 1992, TVA employs a least-cost system planning process in developing its IRPs. This process takes into account multiple factors, including: the demand for electricity, energy resource diversity, energy conservation and efficiency, renewable energy resources, flexibility, dispatchability, reliability, resiliency, costs, risks, environmental impacts, and the unique attributes of different energy resources.

Proposed Issues To Be Addressed

Based on discussions with both internal and external stakeholders, TVA anticipates that the scope of the IRP EIS will include the cost and reliability of power, carbon reduction efforts, the availability and use of renewable and distributed energy resources, the effectiveness and implementation of demand side management options, the effect of energy efficiency programs, and the relationship of the economy to all of these options. The IRP EIS will address the effects of power production on the environment, including climate change, the effects of climate change on the TVA region, and the waste and byproducts of TVA's power operations.

Because of its nature as a planning document, the IRP will not identify specific locations for new resource options. Site-specific environmental effects of new resource options will be addressed in later site-specific assessments tiered off this programmatic EIS. Therefore, in this programmatic environmental impact statement, TVA anticipates that the environmental effects examined will primarily be those at a regional level with some extending to a national or global level. Preliminary issues identified by TVA that will be reviewed in this analysis include:

- emissions of greenhouse gases,
- fuel consumption,
- air quality,
- water quality and quantity,
- waste generation and disposal,
- land use,
- ecological,
- cultural resources, and
- socioeconomic impacts and environmental justice.

TVA invites suggestions or comments concerning the list of issues which should be addressed, including suggestions for how TVA can effectively reach and receive comments from environmental justice communities during the NEPA process. TVA also invites specific comments on the questions that will begin to be answered by this IRP:

- How do you think the demand for energy will change between now and 2050 in the TVA region?
- Should the diversity of the current power generation mix (*e.g.,* nuclear, coal, natural gas, hydroelectric, renewable resources) change? If so, how?
- How should distributed energy resources be considered in TVA planning?
- How should energy efficiency and demand response be considered in planning for future energy needs and how can TVA directly affect electricity usage by consumers?
- And how will the resource decisions discussed above affect the reliability, dispatchability (ability to turn on or off energy resources), and cost of electricity? Are there other factors of risk to be considered?

Analytical Approach

TVA employs a scenario planning approach when developing an IRP. Scenario planning provides an understanding of how the results of near-term and future decisions would change under different conditions over the planning horizon. The major steps in this approach include identifying the future need for power, developing scenarios (*i.e.,* alternate plausible futures outside of TVA's control with different economic and regulatory conditions) and strategies (*i.e.,* alternate business approaches within TVA's control), determining potential supply-side and demand-side energy resource options, developing portfolios associated with the strategies, and ranking strategies and portfolios. The 2019 IRP, developed with extensive public involvement, evaluated five alternative energy resource strategies that differed in the amount of purchased power, energy efficiency and demand response efforts, renewable energy resources, natural gas, and nuclear generating capacity additions, and coal-fired generation. The alternative strategies were analyzed in the context of six different scenarios that described plausible future economic, financial, regulatory, and legislated conditions, as well as social trends and adoption of technological innovations. TVA then developed a preferred alternative, the Target Power Supply Mix, based on guideline ranges for key energy resources. In developing the Target Power Supply Mix, TVA conducted least-cost planning taking into account customer priorities of power cost and reliability, as well as other comments it received during the public comment periods regarding demand for electricity, energy resource diversity, energy conservation and efficiency, renewable energy resources, flexibility, dispatchability, reliability, environmental impacts, and risks. The Target Power Supply Mix established ranges, in MW, for coal plant retirements and additions of nuclear, hydroelectric, demand response, energy efficiency, solar, wind, and natural gas capacity. TVA anticipates using an analytical approach similar to that of the 2019 IRP/EIS described above. The number of alternative energy resource strategies and scenarios to be evaluated may differ from the 2019 IRP/EIS and will be determined after the completion of scoping.

Scoping Process

Scoping, which is integral to the process for implementing NEPA, provides an early and open process to ensure that (1) issues are identified early and properly studied; (2) issues of little significance do not consume substantial time and effort; (3) the draft EIS is thorough and balanced; and (4) delays caused by an inadequate EIS are avoided.

With the help of the public, TVA will identify the most effective energy resource strategy that will meet TVA's mission and serve the people of the region between now and 2050. To ensure that the full range of issues and a comprehensive portfolio of energy resources are addressed, TVA invites members of the public as well as Federal, state, and local agencies and Indian tribes to comment on the scope of the IRP EIS, including potential alternative energy resource strategies. In addition, TVA invites the public to identify information and analyses relevant to the IRP EIS. As part of the IRP process and in addition to other public engagement opportunities, TVA is assembling representatives from key stakeholders to participate in an IRP Working Group that will discuss tradeoffs associated with different resource options and assist TVA in developing an optimal energy resource strategy.

Comments on the scope of this IRP EIS should be submitted no later than the date given under the **DATES** section of this notice. Written requests by agencies or Indian tribes to participate as a cooperating agency or consulting party must also be received by this date. Any comments received, including names and addresses, will become part of the administrative record and will be available for public inspection.

After consideration of the comments received during this scoping period, TVA will summarize public and agency comments, identify the issues and alternatives to be addressed in the EIS, and identify the schedule for completing the EIS process. Following analysis of the issues, TVA will prepare a draft EIS for public review and comment. Notice of availability of the draft EIS will be published by the U.S. Environmental Protection Agency in the **Federal Register**. TVA will solicit written comments on the draft IRP and EIS and also hold public meetings for this purpose. TVA expects to release the draft IRP and EIS in early 2024. TVA anticipates issuing the final IRP and EIS in 2024.

Authority: 40 CFR 1501.9.

Susan Jacks,

General Manager, Environmental Resource Compliance.

[FR Doc. 2023–10652 Filed 5–18–23; 8:45 am]

BILLING CODE 8120–08–P

TENNESSEE VALLEY AUTHORITY

Cheatham County Generation Site Environmental Impact Statement

AGENCY: Tennessee Valley Authority.

ACTION: Notice of intent.

SUMMARY: The Tennessee Valley Authority (TVA) intends to prepare an Environmental Impact Statement (EIS) to address the potential environmental impacts associated with the proposed construction and operation of a simple cycle Combustion Turbine (CT) plant and Battery Energy Storage System (BESS) on a parcel of TVA-owned land in Cheatham County, Tennessee. The Cheatham County Generation Site (CHG) would generate approximately 900 Megawatts (MW) and replace generation capacity for a portion of the Cumberland Fossil Plant (CUF) second unit retirement planned by the end of 2028. The CHG CTs would be composed of multiple natural gas-fired frame CTs and natural gas-fired and oil-fired (*i.e.,* dual-fuel) Aeroderivative CTs. CHG would provide flexible and dispatchable transmission grid support and facilitate the integration of renewable generation onto the TVA bulk transmission system, consistent with the 2019 Integrated Resource Plan (IRP). TVA is inviting public comment concerning the scope of the EIS, alternatives being considered, and environmental issues that should be addressed as a part of this EIS.

DATES: The public scoping period begins with the publication of this notice of intent in the **Federal Register**. To ensure consideration, comments must be postmarked, submitted online, or emailed no later than June 20, 2023. To facilitate the scoping process, TVA will hold an in-person public open house; see *https://www.tva.gov/NEPA* for more information on the meeting.

ADDRESSES: Written comments should be sent to J. Taylor Johnson, NEPA Compliance Specialist, 1101 Market Street, BR 2C–C, Chattanooga, Tennessee 37402. Comments may also be submitted online at: *https://www.tva.gov/NEPA* or by email at *nepa@tva.gov.*

FOR FURTHER INFORMATION CONTACT: For general information about the project, please contact J. Taylor Johnson, NEPA Compliance Specialist, by mail at 1101 Market Street, BR 2C–C, Chattanooga, Tennessee 37402, by email at *nepa@tva.gov,* or by phone at 423–751–2732.

SUPPLEMENTARY INFORMATION: This notice is provided in accordance with the Council on Environmental Quality's Regulations (40 CFR parts 1500 to 1508) and TVA's procedures for implementing the National Environmental Policy Act (NEPA). TVA is an agency and instrumentality of the United States, established by an act of Congress in 1933, to foster the social and economic welfare of the people of the Tennessee Valley region and to promote the proper use and conservation of the region's natural resources. One component of this mission is the generation, transmission, and sale of reliable and affordable electric energy.

TVA Transmission System

TVA provides electricity for local power companies serving 10 million people in Tennessee and parts of six surrounding states, as well as directly to large industrial customers and Federal installations. TVA is fully self-financed without Federal appropriations and funds virtually all operations through electricity sales and power system bond financing. Dependable electrical capacity on the TVA power system is approximately 38,000 MW. TVA transmits electricity from generating

TVA

B

Appendix B – Media Notice

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TVA Engaging Public for Input on Next Integrated Resource Plan

May 22, 2023

- TVA is preparing for its next Integrated Resource Plan (IRP), which is expected to be completed in 2024.
- The IRP serves as a guide to how the agency can best meet energy demand in the coming decades. The process includes public input and engagement, under the National Environmental Policy Act or NEPA, preparing an environmental impact statement (EIS) that will review the potential environmental impacts of the IRP.
- Public comments on the scope of that document are being accepted through Monday, July 3, 2023.

KNOXVILLE, Tenn. – The Tennessee Valley Authority is engaging the public for input on what should be considered in the agency's next Integrated Resource Plan (IRP) and the potential environmental impacts of that plan.

An IRP serves as a compass, guiding the federal utility on how to best meet expected energy demand in the coming decades. The current IRP was completed in 2019. This next IRP is expected to be completed in 2024.

"TVA serves one of the fastest growing regions in the nation – people are moving to our seven-state service area at six times the national average for better jobs and quality of life," said Jeff Lyash, TVA President and CEO. "This growth is exciting, but it also carries with it load growth for TVA. We must continue providing our communities and customers with energy security – energy that is affordable, reliable and resilient – while also being clean. That's why it's important to take a detailed look at where we're headed through an integrated resource plan."

The comprehensive study includes describing TVA's resource needs, policy goals, physical and operational constraints, risks, and proposed resource choices. Stakeholders are engaged throughout the process, reviewing the planning information and shaping the analysis and outcomes. More information can be found at tva.com/irp.

"The IRP process is critical in ensuring we have input from all voices -- our customers, stakeholders, and public -- in preparing energy options to serve our region long term," added Lyash.

As part of the IRP decision-making process, and in alignment with the National Environmental Policy Act (NEPA), TVA will analyze potential environmental impacts associated with the next IRP by preparing an environmental impact statement (EIS). The Notice of Intent (NOI), published in the Federal Register on May 19, 2023, and available at tva.com/irp, is the first step in the NEPA process and the IRP.

TVA is accepting public comments on the next IRP and the scope of the environmental review. **Comments must be submitted no later than Monday, July 3, 2023**. All comments received, including names and addresses, will be considered part of the official record and available to the public.

Comments and input can be submitted online at tva.com/irp, by email to IRP@tva.gov and by mail to Kelly Baxter, NEPA Project Manager, 400 W. Summit Hill Drive, WT 11B, Knoxville, Tenn. 37902.

more information and answer questions about the EIS and the IRP process. Visit tva.com/irp for more information on the virtual public meetings.

About TVA

The Tennessee Valley Authority is the nation's largest public power supplier, delivering energy to 10 million people across seven southeastern states. TVA was established 90 years ago to serve this region and the nation by developing innovative solutions to solve complex challenges. TVA's unique mission focuses on energy, environmental stewardship, and economic development. With one of the largest, most diverse, and cleanest energy systems – including nuclear, hydro, solar, gas, and advanced technologies – TVA is a leader in our nation's drive toward a clean energy future.

TVA is a corporate agency of the United States, receiving no taxpayer funding, deriving virtually all of its revenues from sales of electricity. In addition to operating and investing its revenues in its electric system, TVA provides flood control, navigation, and land management for the Tennessee River system, and assists local power companies and state and local governments with economic development and job creation.

Contact

Scott Brooks
Public Relations
sbrooks@tva.gov
865-632-7453

TVA Media Line

Our media staff is available 24 hours a day. If you cannot reach the contact above, please call our media line at 865-632-6000.

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TVA

C

Appendix C – Scoping Webinar Materials

2024 Integrated Resource Plan (IRP)

Public Scoping Webinar

TENNESSEE VALLEY AUTHORITY

About Today's Meeting

A recording of this presentation will be available on the TVA 2024 IRP website.

2024 IRP website: www.tva.gov/IRP.

There will be an opportunity for clarifying questions at the end of the presentation using either the Q&A functionality of the Teams webinar or by submitting clarifying questions to IRP@tva.gov with the subject line "Scoping Meeting Q&A".

Webinar Agenda

Welcome and Meeting Purpose

Stakeholder Engagement

Objective and Purpose of TVA’s Integrated Resource Plan (IRP) Study

Overview of National Environmental Policy Act (NEPA) Process and Programmatic Environmental Impact Statement (EIS)

Clarifying Questions from Audience

Closing Remarks and How to Provide Comments

Welcome and Meeting Purpose

Brian Child
Vice President, Enterprise Planning

TVA’s Integrated Resource Plan

The IRP is a study of how TVA could meet customer demand for electricity between now and 2050 across a variety of future environments.

A programmatic Environmental Impact Statement (EIS) accompanies the IRP to address its environmental effects.

An updated IRP is needed in order to:

- Proactively establish a strong planning foundation for the 2030s and beyond
- Inform TVA’s next long-range financial plan

The IRP provides strategic direction on how TVA will continue to provide low-cost, reliable, and increasingly cleaner electricity to the 10 million residents of the Tennessee Valley.

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2019 IRP - TVA Board Action and Direction*

Approved the planning direction in the 2019 IRP.

Directed TVA staff to monitor signposts to appropriately consider possible adjustments to the planning direction:

- Changing market conditions
- More stringent regulations
- Technology advancements

Directed TVA staff to initiate the next IRP no later than 2024.

*August 22, 2019, TVA Board Meeting

TVA TENNESSEE VALLEY AUTHORITY

2019 IRP Key Signposts

- Demand for Electricity
- Operating Costs for Existing Units
- Natural Gas Prices
- Solar and Wind Costs
- Stakeholder Expectations
- Emerging and Developmental Technologies
- Regulatory Requirements

What is Public Scoping?

As TVA updates its power generation strategy, the first step is to understand the environment we're planning in, which is referred to as scoping.

We ask the general public, our customers, and our partners and regulators about their ideas regarding the generation needs of the future.

With this information, we develop key assumptions to study which are transformed into candidate resource plans to be evaluated for viability and environmental impact.

We also ask the public to comment on potential environmental issues and concerns that should be addressed in the EIS.

Stakeholder Engagement

Althea Jones
Sr. Manager, Public and Community Engagement

TENNESSEE VALLEY AUTHORITY

TVA Customer & Stakeholder Engagement

- Seeking input from and listening to our customers and stakeholders is foundational to our mission – serving the people of the Tennessee Valley
- TVA seeks customer and stakeholder input and feedback on an ongoing basis through forums such as:
  - Federal Advisory Committees – Regional Energy Resource Council (RERC) and Regional Resource Stewardship Council (RRSC)
  - Utility of the Future Information Exchange
  - Valley Pathways Study
  - Quarterly TVA Board Listening Sessions
  - Regional engagement teams
- A key element of TVA's IRP process is to ensure active public involvement and direct engagement with a diverse group of stakeholders.

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Stakeholder Engagement and the IRP

IRP Working Group (IRPWG)

Regional Energy Resource Council (RERC)

Public Scoping meetings

Periodic informational webinars

Public meetings on the Draft IRP report

2024 IRP Objective and Purpose

Clifton Lowry
Director, Resource Planning & Strategy

TENNESSEE VALLEY AUTHORITY

TVA's Integrated Resource Planning

Collaboration with stakeholders to envision the generation needs of the future.

Based on a least-cost planning framework.

Provides foundation for developing long-range financial plans.

Considers a number of potential futures to help predict changes in the marketplace.

The IRP functions like a compass, not a GPS

Planning is Grounded in Least-Cost Principles

In resource planning, TVA applies fundamental least-cost planning principles*:

Low Cost	Risk Informed	Environmentally Responsible
Reliable and Resilient	Diverse	Flexible

*In alignment with the Energy Policy Act of 1992

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Resource Planning Is About Solving Puzzles

By asking a lot of questions, like …

How much energy will our customers use in the future?

What alternatives do we have to meet our resource needs?

Are there strategic considerations that will limit the alternatives we can consider?

How do we properly evaluate these resource alternatives?

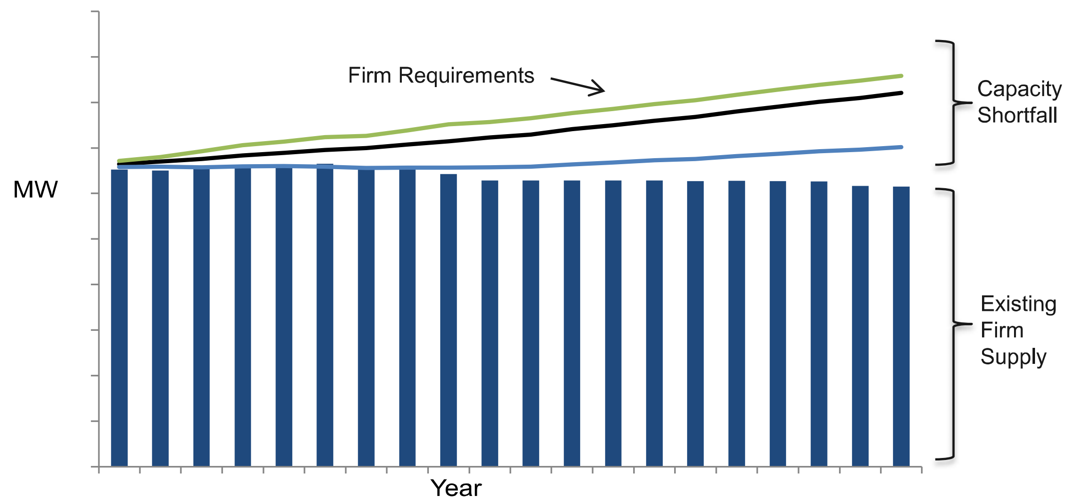
How do we find the best solution?

Which plan (portfolio) do we select?

Resource Planning Addresses Future Capacity Needs

Resource planning is about optimizing the mix of future capacity.

Projections of capacity needed are filled by the most cost-effective resources that meet system needs.



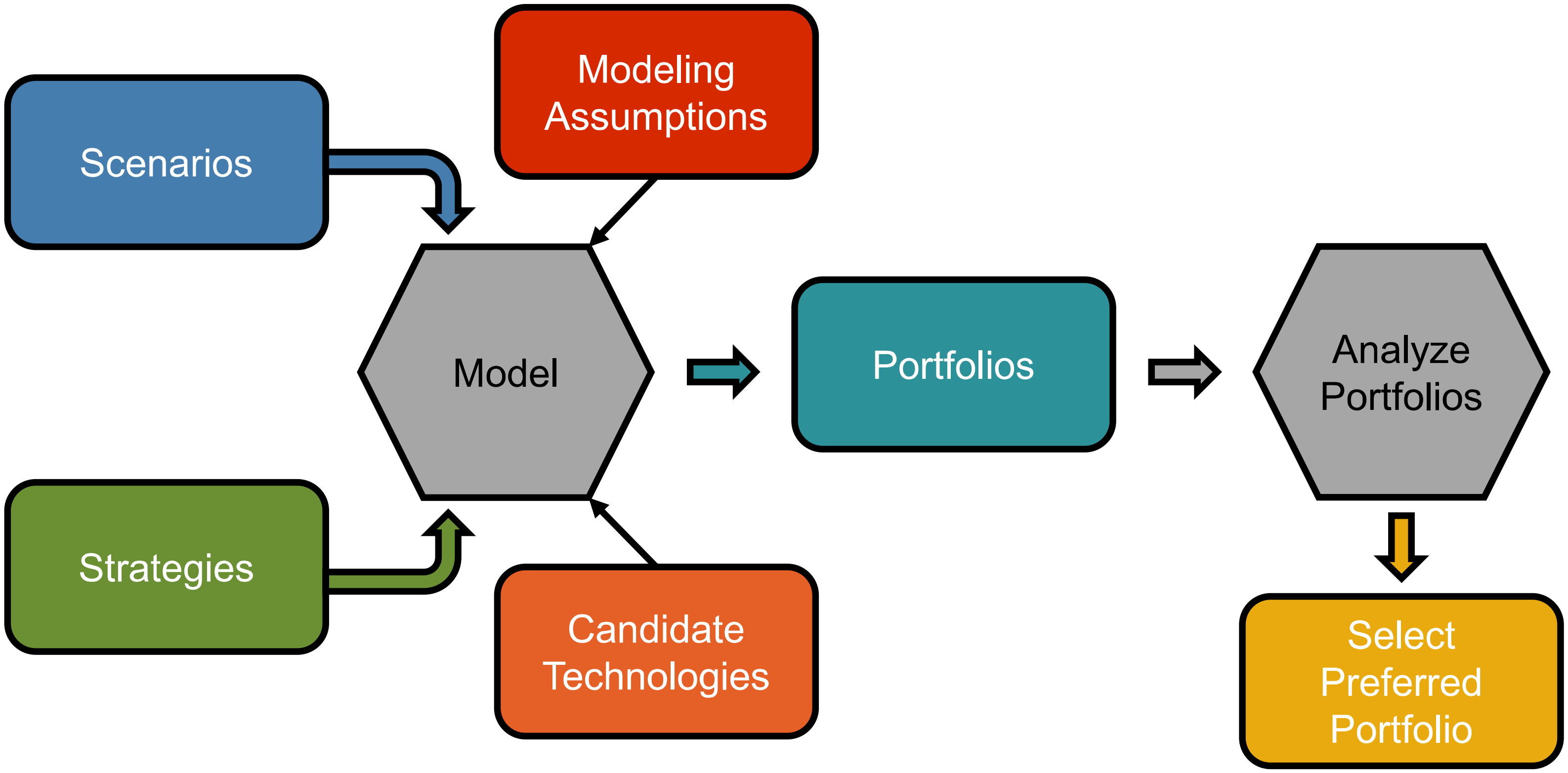
TENNESSEE VALLEY AUTHORITY

The TVA Resource Planning Process

Resource Planning is a common practice in the utility industry to identify the least cost solution to meet customer demand over a long horizon (typically 20-30 years)

Develop Load Forecast	Project customer demand for electricity in the future
Define Existing Resources	Define the resources currently available to meet customer demand and how that will change in the future
Establish Need for Resources	Compare future customer demand with existing resources
Identify Resource Options	Identify all resources (supply- and demand-side) that will be considered to meet future need
Analyze Portfolios	Test different resource combinations (portfolios) to evaluate performance
Select Preferred Portfolio	Select the preferred combination of resources

How the Resource Planning Process Works



Stakeholder feedback is a key component in the development of all model inputs

2019 IRP Results

In addition to providing the strategic direction for TVA's future energy supply, the 2019 IRP recommended near-term actions that have been integrated into TVA's asset strategy.

2024 IRP Considerations

Reliability, affordability, and resiliency

Dispatchability

Electrification and load growth

Carbon reductions and net zero

Renewables and storage

Climate impacts

Environmental justice

Other Risks

IRP Supports TVA's Long-Range Financial Plan

The IRP will:

- Use least-cost planning criteria
- Incorporate resource capital, operating, fuel, and environmental compliance costs
- Include Valley economics as key criteria to evaluate strategies
- Evaluate socioeconomic and climate impacts of alternative strategies in the associated EIS

The IRP will not:

- Establish wholesale or retail electricity rates
- Identify specific sites for new resources
- Be a Distribution Integrated Resource Plan (DIRP)

Key IRP Dates

The 2024 IRP study approach is intended to enable stakeholder involvement and ensure transparency

- Spring ‘23 – Publication of Notice of Intent (NOI) and public scoping initiation
- Summer ‘23 – IRP Working Group commences
- Fall ‘23 – Public scoping report published
- Fall/Winter ‘23 – Modeling and environmental study
- Spring ‘24 – Publish Draft IRP and EIS, public comment period begins
- Spring/Summer ‘24 – Respond to Draft comments and develop Final documents
- Summer ‘24 – Publication and TVA Board adoption of Final IRP and EIS

IRP Environmental Impact Statement (EIS)

Kelly Baxter
NEPA Project Manager

TENNESSEE VALLEY AUTHORITY

IRP EIS Purpose and Approach

National Environmental Policy Act (NEPA)

Decision-makers informed of environmental impacts

Public involvement

System-wide study of environmental impacts

Programmatic EIS

EIS Process and Milestones

1. Public Scoping*
2. Prepare Draft EIS
3. Public Review Draft EIS*
4. Prepare Final EIS
5. Issue Final EIS
6. Issue Record of Decision

*Opportunity for public feedback

EIS Analyzes Key Environmental Factors

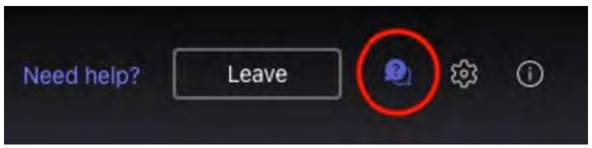
The EIS will assess broad region-wide impacts of the next IRP on environmental factors such as:

- Air quality and climate impacts
- Water resources
- Fuel requirements
- Waste production
- Land requirements
- Socioeconomics and environmental justice

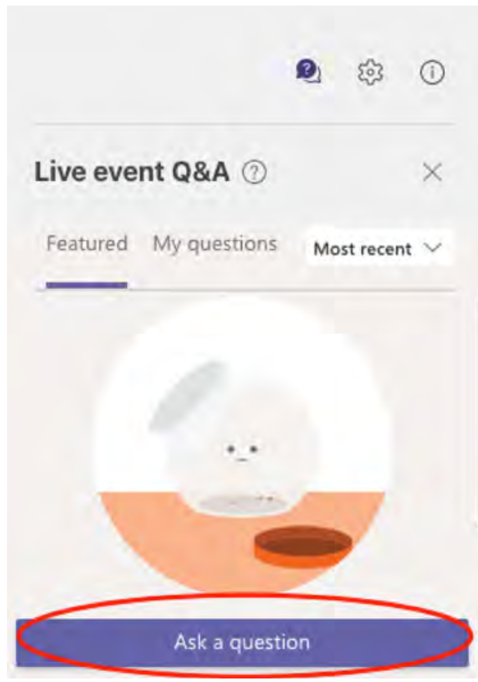
Clarifying Questions from Audience

Q&A Operation

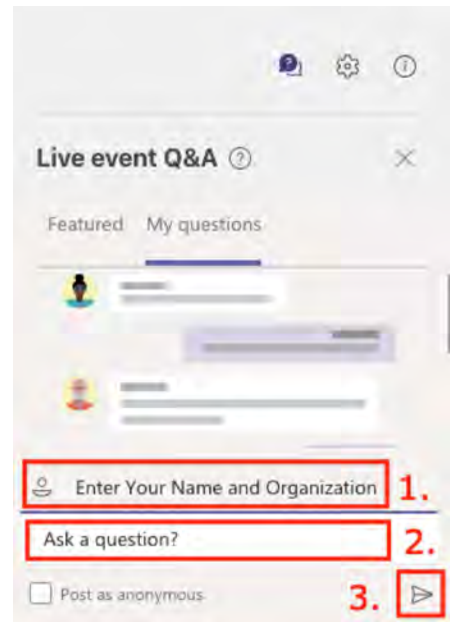
1. Click the Q&A button



2. Click "Ask a Question"



3. Please enter your name and organization in box 1, your question in box 2, then the arrow to submit



TVA TENNESSEE VALLEY AUTHORITY

Recap: IRP Public Scoping

As TVA updates its power generation strategy, the first step is to understand the environment we're planning in, which is referred to as scoping.

We ask the general public, our customers, and our partners and regulators about their ideas regarding the generation needs of the future.

With this information, we develop key assumptions to study which are transformed into candidate resource plans to be evaluated for viability and environmental impact.

We also ask the public to comment on potential environmental issues and concerns that should be addressed in the EIS.

Clarifying questions from the audience?

Use the Q&A box or email your question to IRP@tva.gov (subject: "Scoping Meeting Q&A")

Closing Remarks

Opportunities to Stay Involved

TVA Website www.tva.gov/IRP.

Submit comments during the scoping period (ends July 3rd, 2023).

Attend periodic informational webinars.

Add your name to the IRP mailing list at www.tva.gov/IRP to be notified when documents are released.

Submit comments on the Draft IRP/EIS Report, expected to be available in early 2024.

We Want Your Input!

Ways to provide comments:

- Use the online IRP comment form at www.tva.gov/IRP.
- Email your comment to IRP@tva.gov.
- Mail written comments to:

  Kelly Baxter, NEPA Specialist

  400 W Summit Hill Dr., WT 11B

  Knoxville, TN 37902-1499

Comments must be received before the scoping period ends on July 3rd, 2023

TVA

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VALLEY
AUTHORITY

TVA

D

Appendix D – Public and Agency Comments

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#1]
Date:	Thursday, May 18, 2023 2:14:06 PM

Name	Jeff Coppala
City	Knoxville
State	Tn
Organization	Taxpayer
Email	
Phone Number	

Please provide your comments by uploading a file or by entering them below. *

The IRP should guarantee the residents served a plentiful, economic supply of American energy with a priority on utilizing raw materials sourced in this great country. Energy sources relying on raw materials from countries which are adversaries should be avoided completely. Power outages due to unreliable power management should be eliminated. Power sources such as solar and ewi d which consume vast land areas while producing inconsistent power should be avoided at all costs. No S/C or direct investment should be made in this unreliable technologies

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#2]
Date:	Friday, May 19, 2023 11:44:31 AM

Name	Paul
City	Clifft
State	Tn
Organization	TVA
Email	
Phone Number	

Please provide your comments by uploading a file or by entering them below. *

Wind power and solar has such a small output for what the TVA system needs daily. With the Southeast growth rate with residential and industrial companies the Small modular reactors has to be implemented into the power grid. TVA has been getting away from the coil plants for environmental and health reasons. The small module reactors will be a clean source of power for the future. The next 10 years will be just like it was in the 1970's when every house had their first air conditioning units installed. The power demand spiked. With blue oval coming TVA needs more power.

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#3]
Date:	Monday, May 22, 2023 8:18:13 AM

Name	Landon Warstler
City	New Johnsonville
State	TN
Email	
Phone Number	

Please provide your comments by uploading a file or by entering them below. *

Reuse the large pumps like CCWs from retiring plants. Recirc some hydro flow. Pump back to the reservoir with base load during low demand. The efficiency sucks but it is the cheapest and most environmentally sound battery. The higher pressure pumps like BFPs could be used with a ram jet for higher flow.
Ultimately put a stand by aero at these sites for peaking or potential black starts, powered by LNG barge. The LNG is far superior to fuel oil especially with spills on the riverfront.
Several ways to get new generation using what you already have.

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#4]
Date:	Tuesday, May 23, 2023 12:46:49 AM

Name	Catherine Urcheck
City	Rockwood
State	Tn
Email	
Phone Number	
Please provide your comments by uploading a file or by entering them below. *	We prefer natural gas and solar combo. All solar does not seem feasible as it would probably require a large amount of land. Which may require use of farm land or cutting down trees.

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#5]
Date:	Tuesday, May 23, 2023 1:39:49 PM

Name	Kent Minault
City	Knoxville
State	TN
Organization	Sierra Club
Email	
Phone Number	

Please provide your comments by uploading a file or by entering them below. *

A report last year from Environment North Carolina found that a U.S. gas pipeline incident occurs every 40 hours. And a lot more gas is leaking than what's captured in federal reports. A 2020 study estimated that there are over half a million leaks in our gas distribution system, and the leakage is five times greater than EPA estimates.

Now take a look at TVA's proposals for new energy generation:
• Building a combined cycle gas plant at Cumberland that will generate about 1,500 megawatts. This gas plant is intended to replace one of two aging coal units at the Cumberland Fossil Plant in middle Tennessee.
• Installing three simple cycle combustion turbines that produce 250 megawatts each at the Colbert gas plant in Alabama.
• Installing three simple cycle combustion turbines that produce 250 megawatts each at the Paradise gas plant in Kentucky.
• Installing aero-derivative combustion turbines at the Johnsonville gas plant, producing 500 megawatts.
• Building 200 megawatts of solar in Lawrence County.
• Building 100 megawatts of solar on top of coal ash, pending environmental review, at the Shawnee Fossil Plant in Kentucky.
• Building 20 megawatts of battery storage at Vonore.

The proportions are all wrong here. This is 3,500 MW of new gas, each requiring extensive new gas pipeline infrastructure, and only 320 MW of solar and storage. I notice in the DEIS for Kingston that gaps in transmission infrastructure seem to be holding back TVA from deploying more solar. This suggests that more resources need to be directed toward the grid and fewer to new gas plants. Gas is already the single largest component of TVA's generating resources. Adding to it is compounding TVA's already large climate impact by creating more gas leaks and potential blowouts. Let's reverse the percentages in the proposed new generation and build the clean energy infrastructure and generating resources the future requires.

From: Wufoo
To: Integrated Resource Plan
Subject: 2024 Integrated Resource Plan [#6]
Date: Friday, June 2, 2023 8:28:40 AM

Name	Amy Reed
City	Greenback
State	Tennessee
Email	
Phone Number	

Please provide your comments by uploading a file or by entering them below. *

TVA needs to build wind & solar farms ASAP as well as more lines & substations. I live in Blount County's side of Greenback and work in Maryville. And Blount Partnership in concert with the County Commission, Maryville, and Alcoa city councils have been recklessly allowing building without having the utility infrastructure upgraded. TVA sadly has to play catch-up as the rolling black-outs this past Christmas were an indication of how unfortunately back-footed TVA is at the moment, which is due from previous decades of lack of sufficient Federal funding in infrastructure in general.

Renewable clean energy such as wind & solar farms, more substations to distribute/carry the load, and any chance TVA has the authority or cache to tell our local governments & Blount Partnership to pump their brakes- that would certainly help. I can only imagine the strain the 3 Amazon facilities and the Smith & Wesson plant will be adding to Blount's electrical grid.

From: Wufoo
To: Integrated Resource Plan
Subject: 2024 Integrated Resource Plan [#7]
Date: Friday, June 2, 2023 2:21:48 PM

Name	scott shuttleworth
City	ROGERSVILLE
State	TN
Email	
Phone Number	
Please provide your comments by uploading a file or by entering them below. *	I would like to see some type of easy access for boating like canoes and or kayaks etc. to be able to maneuver through or around the damn area if at all possible. Hopefully something like this could be considered .

Old Washington Pike
Knoxville, TN 37918
May 31, 2023

Kelly Baxter
NEPA Project Manager
400 W. Summit Hill Dr.
Knoxville, TN 37902

RE: Comments, Integrated Resource Plan

Dear Sir, Madam:

Before I offer some specific solutions or recommendations, I first will give you my background and history with TVA. My father, originally from New York, came to Tennessee in 1936 to begin his career with TVA. His first field project was at Great Falls Dam (acquired by TVA in 1939 from a private utility). The reservoir had developed numerous leaks in the rock fissures. TVA reduced the leakage by 98%. My father wrote a paper that was published in the American Society of Civil Engineers Transactions in 1950 Titled: Correction of Reservoir Leakage at Great Falls Dam. He next went to Hales Bar Dam near Chattanooga, TN to correct similar leakage.

He was promoted to Project Manager to build Widows Creek Steam Plant. He completed it on schedule and under budget. He was the youngest person ever to be selected as project manager. He was next assigned as Project Manager of the Gallatin Steam Plant. Then Project Manager of the Paradise Steam Plant in Kentucky. Each succeeding steam plant was the largest in the world. Although each had its own challenges and required 1000s of skilled disciplines to build, I heard him comment that they were like giant erector sets.

The real challenges came when he was selected Project Manager of the Nickajack Dam near South Pittsburg, TN; it was intended to replace the antiquated Hales Bar Dam. Then he was Project Manager at the Tim's Ford Dam near Winchester. His final assignment before retiring was as Project Manager at Racoon Mountain Pumped Storage Project. He was responsible for putting more electric power in the TVA system that any other person. Needless to say, we moved a lot, new schools and friends.

I received a BS in Forestry from UT in 1968. When I was discharged from the army, I began working for TVA Division of Forestry, Fisheries, and Wildlife in 1972.

One of the charges of the TVA Act was reforestation of the Valley, so in a sense TVA is a conservation organization.
When TVA began its nuclear power program it made the decision to also get in the uranium mining business. It opened a large office in Casper, Wyoming and a satellite office in Moab, Utah. TVA had exploration operations in Wyoming, Utah, Colorado, Texas, Michigan, South Dakota, New Mexico. TVA spent millions of dollars to develop the Morton Ranch Mine in Wyoming, never opened. Also, millions of dollars were expended in Edgemont, SD to purchase an old valadium mill to process yellow cake uranium. Never developed and TVA was stuck with a toxic leaking radioactive plant.
One of my jobs was to go west twice a year to assure that the exploration sites were properly reclaimed, drill holes plugged, trash and bags that drilling mud came in were picked up and each site was graded and reseeded. Much of this exploration was on private land as well as the Navajo Indian Reservation.
So, all this was the old TVA way of thinking, each new nuclear plant would be bigger than the next. Millions spent on Belafonte, Phipps Bend etc. with nothing to show for it. I very much enjoyed going out west to do a job unique to me. But, while I was doing it, I always thought in my mind that this was too much too fast, and it came true.
So, where does TVA go from here, what is TVAs future, what is TVAs mission for the people of the Valley and the power service area?
My father said that coal fired plants had a life of about 50 years. We are seeing that now as some are being dismantled. TVA needs to ask itself, do solar panels and windmills have a 50-year life? It is very doubtful plus their disposal presents serious problems.
I think nuclear power is the proper course to take. It is clean and safe under certain conditions. Bigger plants are a way of the past. Small plants of standard designed dispersed through out the TVA power service area is the path to take. It does two things, first the designed is standard, a design cost savings, but leaves openings for new technologies, second the plants are dispersed allowing security from cyber-attacks. TVA is known for its leadership in electrical power. TVA could and should become a leader and an innovator in cyber security.
Leave the EVs to the auto industries and other lithium ideas that involve child slave labor to produce. Stay with what TVA knows best, producing power efficiently and safety and guaranteeing no black outs for the people of the Valley.
Thank you for the opportunity to comment.

Sincerely,

Stephen G. Weber

From: Wufoo
To: Integrated Resource Plan
Subject: 2024 Integrated Resource Plan [#8]
Date: Tuesday, June 13, 2023 1:35:20 PM

Name	Julian Williams
City	Knoxville
State	Tennessee
Organization	Sozo Energy Inc
Email	
Phone Number	
Please provide your comments by uploading a file or by entering them below. *	Using privately owned rooftop solar, whether it be residential or commercial as a viable solution to TVA's energy needs.

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#9]
Date:	Thursday, June 15, 2023 5:08:05 PM

Name	Joanne Nielenz
City	Rockwood
State	TN
Organization	Realtor
Email	
Phone Number	
Please provide your comments by uploading a file or by entering them below. *	I would like to see it decommissioned and deconstructed converting into a clear energy is important to us and the environment. Solar even gas fired I would be for but this site to me has such a negative image after the coal ash spill. I would love to see those towers gone. As a Realtor selling property everyone I work with has a comment about the plant. While I am all for creating energy I want it cleaner Thank you for your time

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#10]
Date:	Thursday, June 22, 2023 12:12:02 PM

Name	Adell Daly
City	Kingston Springs
State	TN
Email	
Please provide your comments by uploading a file or by entering them below. *	At what point will regard for life be above that of the desire for money? As someone who lives in Cheatham County, TN, I am 100% against this. It will negatively affect everyone, human and animal alike, who lives here.

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#11]
Date:	Wednesday, June 28, 2023 1:49:34 PM

Name	Ben Neff
City	Kingsport
State	TN
Email	

Please provide your comments by uploading a file or by entering them below. *

With the new Vogtle 3 & 4 nuclear power plants nearing completion in Georgia, it would be a travesty to lose the skills, experience, and lessons learned gained from their construction. No one wants to take on the "risk" of new large nuclear reactors, but they offer the best path forward in meeting carbon emission goals while providing reliable electricity generation. The resource use is the smallest of any electricity generating source that is considered for the future and has the added benefit of always on power. Investment in new large nuclear will come at a large upfront cost but provide reliable, cheap energy for decades to come or even a century. Losing the knowledge and experience of constructing the AP1000s in Georgia will come at a great cost to society than the investment could ever be.

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#12]
Date:	Wednesday, June 28, 2023 4:43:44 PM

Name	Michael Barrett
City	Hiawassee
State	GA
Email	
Phone Number	
Please provide your comments by uploading a file or by entering them below. *	Build more nuclear, wind/solar/hydro don't have the base load. Expand nuclear, we don't mind helping finance it. It's for the future and is "clean" energy.

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#13]
Date:	Thursday, June 29, 2023 8:11:32 AM

Name	Ian
State	North Carolina
Email	
Please provide your comments by uploading a file or by entering them below. *	Gen III/III+ nuclear should be the central part of the energy portfolio. They are proven, buildable and reliable 24/7. The existing fleet will have to be replaced after 60-80, so we must start soon to have new units online to replace them with, while also increasing nuclear capacity fleetwide.

EU Etowah Utilities

PHONE (423) 263-9441
OFFICE FAX (423) 263-9444
WAREHOUSE FAX (423) 263-2392
TOLL FREE (877) 224-9441

1313 S. TENN. AVE.
POST OFFICE BOX 927
ETOWAH, TN 37331-0927
www.eubnet.org

Date: June 29, 2023

Subject: TVA Integrated Resource Plan(IRP) 2023, Comments from Etowah Utilities (EU)

To: Tennessee Valley Authority (TVA)

From: Harold Masengil, General Manager, Etowah Utilities

Thank you for the opportunity for us to express our comments on the TVA IRP going forward. It may seem strange that our comments revolve around water flow in the Hiwassee River and not directly on electrical issues. First we do not advocate that TVA spill water without first generating electricity from the water flow on the Hiwassee. However, Etowah Utilities and other municipal owned water utilities experienced taste and odor (T&O) issues that pull their water from the Hiwassee. Tests show that the taste and odor is due to algae in the river bed. EU has pulled water from the Hiwassee River for over sixty-seven years without any taste and odor issues until the Spring of 2023. We have had to modify our treatment scheme in an effort to remove the taste and odor agents. The water meets the safe drinking water standards but, some people cannot drink the water due to the T&O. EU has spent a considerable amount of time and money on what we hope is temporary advanced treatment as well as laboratory testing of the water to measure the T&O agents. Even with this advanced treatment a significant amount of T&O passes through the treatment system to our customer's taps.

We feel that the low flow from TVA during the Spring coupled with higher than normal water temperatures and slow rainfall events created the "Perfect Storm" for conditions favorable to the growth of these problematic algae types. When the water level is low in the river the sunlight can penetrate to deeper depths where the algae reside. The only thing that can be controlled is the flow, therefore, we request that TVA consider providing additional flow down the Hiwassee when they are building the Lake Levels in NC and GA. One generator equates to roughly 1,465 cubic feet per second and this should prove adequate as a minimum level. This is not a recreational issue but a Public Health Issue in that the T&O will drive some water customers to unsafe sources of drinking water. While TVA may have met the minimum flow requirement in the flow charts for the Valley, we feel that more flow should be considered for drinking water sources as well as assimilation of State permitted waste streams in the Hiwassee River water shed. Maybe it is time to update the minimum flow charts. Again, we are not asking TVA to spill water but to adjust the generation so that additional water can be sent down the river while certainly generating much needed electricity for the Valley.

Your consideration will be greatly appreciated.

D. Harold Masengil

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#14]
Date:	Thursday, June 29, 2023 10:21:26 AM

Name	Robert Peel
City	Hendersonville
State	TN
Email	
Phone Number	
Please provide your comments by uploading a file or by entering them below. *	Please build more nuclear power plants and natural gas. Those are the proven clean energy sources (along with hydropower) that are safe, reliable, and can produce electricity all of the time.

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#15]
Date:	Thursday, June 29, 2023 11:43:12 AM

Name	Zack Cochran
City	Falkville
State	AL
Organization	TVA
Email	
Phone Number	

Please provide your comments by uploading a file or by entering them below. *

In order to support the growing energy demands of the Tennessee Valley, which will increase exponentially in the coming years, TVA must begin thinking outside of the box when considering its generation strategy. Additionally, TVA must also begin planning for the future NOW as I expect the agency to see rather sudden load growth as EVs become prevalent, and industrial growth in the Tennessee Valley continues to increase. I believe this can be done in a couple of ways, including the modernization of existing generation assets, as well as co-locating types of generation across TVA's footprint.

First, I would highly encourage TVA to consider modernizing its existing generation assets, specifically around Hydro generation. While it doesn't sound as sexy as solar or wind energy, Hydro power is still the cleanest, most reliable, most efficient, and most economical of all renewable energy sources. TVA has a huge asset in regards to the Tennessee River System, and I believe modernizing existing Hydro plants with either more efficient turbines or converting them to Hydrogen-based generation facilities would make the most sense. TVA's Hydro plants currently harness only a fraction of the river's hydraulic energy due to limitations imposed by hydrology and economics. An option to enhance the efficiency of these power plants involves utilizing the excess or untapped energy by converting water into hydrogen through electrolysis. Subsequently, this hydrogen can be converted back into electricity using a gas turbine or fuel cells. During periods of low demand or when the river experiences significant flows, the generated electricity can be stored in the form of hydrogen. Later, when there is a peak energy requirement, the hydrogen can be reconverted into electricity. A notable advantage of this proposed system is that the water needed to produce hydrogen is readily available at all of TVA's existing Hydro sites. The conversion of electricity to hydrogen at hydroelectric power plants, followed by its utilization in a gas turbine, is both technically feasible and economically viable.

Second, co-location of generation assets on existing TVA properties would be dramatically cheaper than some of the Green Field initiatives that TVA has undertaken. As an example, TVA could consider co-locating SMRs at the 3 existing nuclear plants since these sites already have the necessary infrastructure in place to support nuclear power generation. Even though some of these systems would require modification, this would be much more cost-effective in the long run, and could position TVA's existing BWR/PWR sites to become 100% SMR sites in the future, when taking into consideration the age of some of TVA's nuclear units. Another example would be adding solar/wind capacity at TVA's 500kV substations. These substations usually have large yards with excess space for solar panels, and many have microwave towers that could be replaced with wind turbines as TVA's strategic fiber initiative becomes a reality. An additional example would be in regards to TVA's large transmission system; TVA must begin thinking of transmission towers/structures as “vertical assets” instead of just transmission towers. If TVA's transmission towers could be retrofitted with solar panels or small wind turbines, TVA could have one of the largest renewable systems in the world, while also increasing generation to support the demand from the Tennessee Valley.

In closing, I understand that some of these ideas can seem a bit far-fetched or radical, but I believe this is precisely the type of mindset that TVA must use when determining the agency's direction. There is so much untapped potential and opportunity, and it's up to TVA to develop a path forward in order to take advantage of those opportunities. Innovation at TVA is something that we must continue to evolve, and I believe there is no public power company that is better positioned than TVA. We have an opportunity to become a leader in energy production and innovation, as well as a textbook example of how a government agency should run.

From: Wufoo
To: Integrated Resource Plan
Subject: 2024 Integrated Resource Plan [#16]
Date: Thursday, June 29, 2023 1:59:18 PM

Name	Kyle Bevis
City	Athens
State	AL
Organization	TVA
Email	
Phone Number	
Please provide your comments by uploading a file or by entering them below. *	Hey guys, I currently work at BFN. I had a thought the other day as I was making my long walk into the plant and thought about how cool it would be to have a parking lot make over and have parking lot solar canopies like you see at many places out west! It'd be a neat way to power security lights, provide extra charge where the EV stations are, save the brutal sun on people's vehicles, as well as the health of the parking lots themselves. Just a thought. Thanks!

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#17]
Date:	Thursday, June 29, 2023 11:40:01 PM

Name	Michael McLean
City	Chicago
State	IL
Email	
Phone Number	

Please provide your comments by uploading a file or by entering them below. *

Hello!

I'm a resident in Illinois outside the TVA service region, but I'm a US citizen that is concerned about the future reliability of our national grid as demand increases and baseload generation like coal is taken offline.

I believe that nuclear is well suited to replace the services of coal: it's dispatchable, it has on-site fuel storage, high reliability, and cheap marginal cost. I understand that after Vogtle, many utilities are hesitant to finance new nuclear builds but TVA is uniquely positioned to procure a large program of new nuclear projects to decarbonize its grid. New nuclear is easiest to build when a reactor design is "nth of a kind", and thankfully Southern has retired the "first of a kind" risk of the AP1000 design.

TVA should place a large of reactors, as big as 15 GW to fully retire coal and a lot of gas assets. Nuclear is a great transitional generation technology because it does not displace fossil fuel labor. A new reactor can be built on a "brownfield" site to replace coal or gas generators, and workers can be retrained to work at the nuclear plant. This keeps jobs in small towns, and taxes can continue to fund city services.

Please consider placing a massive order of AP1000, or BWRX-300 to decarbonize your grid.

Thank you,
Michael

June 30, 2023

Kelly Baxter,
NEPA Specialist
Tennessee Valley Authority
400 West Summit Hill Drive,
WT 11B, Knoxville, TN 37902–1499

Re: Tennessee Valley Authority Integrated Resource Plan and Environmental Impact Statement and Environmental Impact Statement

Dear Ms. Baxter,

The Tennessee Farm Bureau Federation (TFBF) represents a diverse aggregate of commodity producers across the state and with over 680,000 members, is the largest general farm organization in Tennessee. On behalf of our member producers, we appreciate the opportunity to submit comments to the Tennessee Valley Authority's (TVA) request for public input on the Integrated Resource Plan (IRP) and Environmental Impact Statement (EIS).

General Principles

Our economic well-being hinges upon our energy cost. The United States needs an energy policy emphasizing expanded production of all forms of energy, including nuclear and hydrogen, and the development of new forms of energy. Conservation alone is not the solution to our energy problem.

Farmers have a deep and long-standing interest in protecting the environment based upon philosophical beliefs and practical self-interest. The environment is essential to all agriculture and our families. Land is typically a farmer's largest asset and primary source of income. Farmers have every incentive to leave this natural resource in better shape for the next generation. Modern agriculture is environmentally sustainable, and farmers strive to constantly improve the environmental resources in their care while playing a significant role in climate solutions. Success in farming is dependent on the environment. Farmers continually strive to balance earning a living from the land while being stewards of the land, air, and water. Increasingly, farmers are asked to produce more using fewer resources, all while decreasing agricultural greenhouse gas (GHG) emissions.

Agriculture can play a role in offsetting emissions beyond the farm gate. From climate-smart farming practices to voluntary management of forests, grasslands, wetlands, and croplands, farmers are reducing their footprint and actively absorbing carbon from the atmosphere. According to the Environmental Protection Agency (EPA), land management practices alone removed 764 million metric tons of carbon dioxide from the atmosphere in 2018. This reduction equals removing 165 million vehicles off the road for a year. Agriculture's full contribution to air quality is incalculable. Clean air and filtration of the atmosphere by vast acres of crops, pastures, and forests on private land mitigate impurities placed into the air by the infrastructure that provides a higher standard of living for each Tennessee citizen.

TVA Power System and Resource Planning

In the summer of 2022, TVA sent letters to all customers encouraging energy conservation because of the high demand on the grid during the heat wave. In June 2022, a record was set of demand at 31,617 megawatts. Then on December 23, TVA recorded the highest 24-hour electricity demand supplied in the history of the agency, 740 gigawatt-hours. TVA CEO Jeff Lyash has expressed publicly demand for energy in the TVA footprint will double over the next 30 years. Based on this information, in the next 30 years, TVA will need to produce over 60,000 megawatts of power. TVA must prepare now for future demand and the anticipated peaks for both summer and winter conditions. We support upgrading the electric grid infrastructure to ensure affordability, security, reliability, and survivability at a cost-effective price for end consumers.

Proposed Issues To Be Addressed

The IRP EIS will address the effects of power production on the environment, including climate change, the impacts of climate change on the TVA region, and the waste and byproducts of TVA's power operations. We recognize the debate over climate change and policies to address it are complex and controversial. Climate change is a global issue, not just a domestic issue. TVA should not sacrifice energy production to meet emissions standards above what the law requires. The economic effects of reducing greenhouse gas emissions (GHGs) are relatively unknown, and we caution TVA to take action to curb GHGs until TVA can ensure affordability, security, reliability, and survivability of energy production.

TVA's goal of acquiring 10,000 megawatts of power from solar energy production by 2035 means solar energy will supply one-third of the energy demand. We are not opposed to solar energy production. There is a market opportunity for farmers and landowners holding solar energy production leases. However, Tennessee farmers are very concerned about the potential impacts of this goal. Our first concern is the long-term stability of the electric grid. Even though solar energy has been successful in other parts of the country, particularly in the West, this type of energy production is not proven in Tennessee. We ask TVA: can solar production meet the future demands of the electric grid? This is especially considering increased population growth, as well as the increased demand for electric vehicles. In less than three years, electric vehicles are expected to account for 14% of the automotive industry, nearly quadrupling the current three percent. The combination of these forces gives the farmers of Tennessee great concern over the future of our electric grid. Our second concern is the impact of farmland loss. For every megawatt of power produced by solar, an average of 8.1 acres of land must be converted to solar energy production. To meet TVA's goal of 10,000 megawatts, over 80,000 acres of land will be converted to solar energy production. For perspective, Trousdale County, Tennessee, is just under 75,000 acres. This is a massive land use change for Tennessee. Much of the land which will be converted to solar energy production will come out of farm production. This will increase farmland costs and rental rates for farmland. In addition to the impact of solar, population growth continues to cause farmland loss. According to research by the University of Tennessee Institute of Agriculture, 1.5 million acres have transitioned from farmland since 1997. This trend will continue as the population grows and the industrial development in the TVA footprint expands, especially around the Blue Oval City site.

TVA must consider the placement of solar energy production sources and give priority to lands not suitable for production agriculture. While energy production is essential, the long-term availability of land for food and fiber production should take precedence. TVA should encourage rooftop solar and other on-site solar placement, especially if industrial development sites are requesting solar energy. Additionally, the proximity of the solar projects to the site means fewer transmission lines and other infrastructure are needed.

Farm Bureau believes any TVA environmental impact study should account for the potentially irreversible loss of productive agricultural land.

Answers to Specific Questions

- **Q1. How do you think the demand for energy will change between now and 2050 in the TVA region?**

  A1. Population growth and increased use of electric products, such as vehicles, will heavily increase energy demand.

- **Q2. Should the diversity of the current power generation mix (e.g., nuclear, coal, natural gas, hydroelectric, renewable resources) change? If so, how?**

  A2. The United States has huge energy resources, and TVA should support utilizing all domestic energy resources, including nuclear, natural gas, coal, hydrogen, methane, hydroelectric, and renewables.

  We support nuclear energy as a clean, safe, and affordable source. The United States must be realistic as we chart a course to guarantee future generations a self-sufficient energy supply. TVA should aggressively research, develop, and expand our nuclear energy capabilities.

  Natural gas provides an increased opportunity to diversify energy sources with fewer GHG emissions. Recent growth in natural gas supply makes it cost-effective. We support the expansion of natural gas infrastructure throughout Tennessee to meet potential needs.

We support clean coal technology. TVA should find ways to use the abundant domestic coal supply more cleanly.

Methane capture opportunities for energy recovery exist in landfills across the state and nation. We encourage TVA to work with local governments, utilities, and private industry to explore the options and available beneficial use options. The conversion of poultry litter and other animal waste for power generation is an opportunity. We support aggressive research to convert such waste to a usable form of energy.

We recognize TVA will need a variety of renewable energy resources, including wind, hydro, solar, and geothermal, to accomplish affordable and reliable energy production.

- **Q3. How should distributed energy resources be considered in TVA planning?**

  A3. We support the expanded production of all forms of energy. It is positive if distributed energy resources (DERS) increase energy production's affordability, security, reliability, and survivability. The placement of DERS should prioritize lands not suitable for production agriculture.

- **Q4. How should energy efficiency and demand response be considered in planning for future energy needs and how can TVA directly affect electricity usage by consumers?**

  A4. TVA needs an energy policy which emphasizes expanded production of all forms of energy. Conservation alone is not the solution to our energy problem.

- **Q5. And how will the resource decisions discussed above affect the reliability, dispatchability (ability to turn on or off energy resources), and cost of electricity? Are there other factors of risk to be considered?**

  A5. We support upgrading the electric grid infrastructure to ensure security, reliability, and survivability. This should be of utmost importance in developing the IRP EIS.

Scoping Process

TVA invites the public to comment on the scope of the IRP EIS. As mentioned, the IRP EIS and any environmental impact study should account for the potentially irreversible loss of productive agricultural land.

Conclusion

We appreciate the opportunity to comment on this topic and are happy to discuss these comments and our members' positions or provide you with further information to the extent you find it useful. The Tennessee Valley Authority provides electrical energy to almost all Tennesseans. Over TVA's history, rural electrification helped farmers significantly improve their living standards and develop the region's resources. We appreciate the leadership TVA has provided in flood control and energy production.

Sincerely,

Eric Mayberry
President
Tennessee Farm Bureau

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#19]
Date:	Friday, June 30, 2023 11:17:15 AM

Name	Jonathan Hamilton
City	Knoxville
State	TN
Organization	Solar Alliance
Email	
Phone Number	

Please provide your comments by uploading a file or by entering them below. *

Statement to TVA by Solar Alliance Southeast
Input for 2024 Integrated Resource Plan
June 30, 2023

The backbone of economic development in our region for decades has been low-cost power provided by TVA. The future, however, should realize the advantages of distributed, clean energy power production and storage; which can be advantaged by the strategic role TVA plays in our region. Our hope is that TVA remains a partner in bringing the advantages of distributed, clean energy power production to the region.

As a member of the Tennessee Solar Energy Industries Association (TenneSEIA), Solar Alliance Southeast is proud to provide skilled local jobs and to participate in the development of a growing solar industry here in Tennessee. Having designed and constructed utility-owned community solar projects with KUB, AEC and, outside of TVA, for LG&E and KU in Kentucky, we respect the challenges that our utility partners experience in developing programs that meet community interest and technical needs.

In response to some of these challenges, we believe the adoption of reliable, decentralized, renewable energy systems that include solar PV and energy storage systems can contribute to solving challenges associated with increasing technology dependence and electrification, adoption of more electric vehicles (EVs) and infrastructure needs, while also supporting job growth and improved resilience.

Meanwhile, LPCs will bear much of the burden in understanding how to best integrate these technologies with grid modernization and reliability efforts, while also managing the cost implications.

We believe that TVA can be a partner in helping to build a more resilient and reliable grid, leveraging the advantages of decentralized, low-cost power production, by participating in the development of

LPC-owned microgrid sites and customer-owned renewable energy and energy storage systems. TVA can lead the way with proactive transmission planning.

TVA's support, whether through structured incentives for end users or LPCs, and especially with technical guidance for adoption of these type systems, would go a long way toward realizing the advantages of distributed energy.

In closing, I want to provide an image of what we feel is possible here and now. In the next few months, one of our commercial clients will have a solar PV system that provides most of their power needs, in conjunction with a containerized energy storage system that can island the facility during an outage, reduce utility demand, and in turn reduce operating cost. In striving to meet their corporate sustainability goal, they will also be demonstrating the possibilities of current technology.

A forward-looking plan for TVA and the communities it serves can achieve all of these things by wisely enlisting ways to use distributed power.

Jon Hamilton - General Manager
Solar Alliance Southeast

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#20]
Date:	Friday, June 30, 2023 12:31:45 PM

Name	philip
City	holocher
State	NC
Organization	Homeowner
Email	
Phone Number	
Please provide your comments by uploading a file or by entering them below. *	I want to breathe clean air and drink clean water. Dirty coal exhaust in the air & coal ash seeping into the water system is bad for people's health. Please install & promote clean energy alternatives that include: solar PV power, wind power, rooftop solar, agrivoltaic solar, geothermal power, heat pumps, geothermal heat pumps, hydro power, energy storage, hydro energy storage and energy conservation with insulation & solar widow film. Thank you.

To the Tennessee Valley Authority Integrated Resource Planning Staff,

Vote Solar is a national nonprofit that has had a strong presence in the Southeast and has worked on dozens of Integrated Resource Plans (IRPs) across the country. Furthermore, Vote Solar has staff that reside in TVA territory.

We are deeply committed to promoting the growth of solar energy and fostering equitable access to clean energy resources. Our mission is founded on the belief that everyone, regardless of their socioeconomic status or geographic location, should benefit from renewable energy solutions. In light of these convictions, we are submitting the following comments to TVA's IRP Scoping Process, focusing particularly on energy justice and the role of distributed energy resources (DERs) in IRPs.

Energy Justice in Integrated Resource Planning

According to the Initiative for Energy Justice[1], energy justice means:

> Energy justice refers to the goal of achieving equity in both the social and economic participation in the energy system, while also remediating social, economic, and health burdens on those disproportionately harmed by the energy system. Energy justice explicitly centers the concerns of communities at the frontline of pollution and climate change ("frontline communities"), working class people, indigenous communities, and those historically disenfranchised by racial and social inequity. Energy justice aims to make energy accessible, affordable, clean, and democratically managed for all communities.

Energy justice can be considered through four primary dimensions, each of which is directly relevant to utility integrated resource plans.

Energy Justice Lens	**Definition**	**Relationship to IRP**
Distributive Justice	Concerned with how impacts of and externalities from the energy system are distributed across society	Who benefits from which types of resource additions? How are just transition principles enacted during plant closures?

[1] https://iejusa.org/

Procedural Justice	Concerned with the participation in, access to, and knowledge of major decision-making processes	Who has a seat at the table during the IRP process? How does TVA bring in voices that holistically have not had the opportunity or resources to participate? How does TVA incorporate input into the IRP?
Recognitional Justice	Concerned with the acknowledgement of differing needs within the energy system across different populations	How does the IRP acknowledge that not all customers receive the same level of service from existing and new resources; and that not all customers have the same socioeconomic baseline to receive service?
Restorative Justice	Concerned with the duty of energy sector actors to rectify past injustices	How do resource decisions build wealth in historically disadvantaged communities?

Historically, energy justice has not been a part of the IRP process nationwide due to a lack of stakeholder advocacy and a narrow interpretation of the role of resource planning. However, this is rapidly changing as energy justice is becoming a key part of IRP proceedings in many states, including Arizona, Michigan, Minnesota, North Carolina, Oregon, and more.

Examples from Oregon and Minnesota

Portland General Electric's 2023 Clean Energy Plan and IRP[2] exemplifies an IRP that incorporates community input and prioritizes justice. Due to HB 2021, PGE is required to file a combined IRP and Clean Energy Plan that includes extensive community engagement and includes meaningful community benefits. The product is an innovative IRP that paves the way for community-informed utility resource planning. A few relevant takeaways include:

- PGE includes Chapters on "Community Benefit Indicators and Community Based Renewables" and "Community Equity Lens and Engagement" in its filed CEP/IRP.
- PGE identified 155 MW of community based renewable potential by 2030.
- PGE includes a 10% adder for community based renewables in certain portfolios.
- PGE hosted several community meetings in a variety of formats to solicit input, and is working towards a "human centered approach to planning."

2
https://downloads.ctfassets.net/416ywc1laqmd/6B6HLox3jBzYLXOBgskor5/db59c8b594a3c380b9d42e90ec9a35aa/2023_PGE_CEP-IRP.pdf

- PGE is in the process of creating a Community Benefits Impact Advisory Committee, required by HB 2021, to inform future CEP/IRPs

Xcel Energy Minnesota is starting to include equity in their resource planning due to stakeholder and intervenor advocacy, as opposed to state legislation[3,4]. Xcel acknowledged, and the Minnesota Public Utility Commission concurred, that resource planning is an appropriate forum to address equity concerns. Intervenors made the following connections between equity and IRPs:

- Alignment of workforce diversity with the communities the utility serves
- Design equitable delivery of programs to energy burdened customers
- Create new options for renewable and energy efficiency
- Enabling equitable access to DERs to low income households and communities of color
- Enhance procedural justice by providing more resources and opportunities for non-traditional actors to participate in the IRP.

The PUC's Order directed Xcel to engage in community outreach on the intersection of equity and resource planning, and file reports in its next IRP and a new equity docket.

How to Enact Procedural Justice in the 2024 IRP

The Tennessee Valley Authority has the authority and the responsibility to bring energy justice into their 2024 IRP process. The TVA is required to "encourage meaningful public participation in and awareness of its proposed actions and decisions[5]." Further, President Biden's 2021 Executive Order[6] on agency equity action plans strengthened earlier executive orders directing federal agencies to act on environmental justice. The TVA, as a federal entity, is obligated to follow the President's lead.

On June 21, 2023, a group of nine organizations, including Vote Solar sent a letter to the TVA Board with recommendations on how the TVA IRP process could increase transparency and meaningful participation by mirroring the IRP process of a regulated utility[7]. We encourage TVA IRP staff to support these recommendations.

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[3] https://www.xcelenergy.com/staticfiles/xe-responsive/Company/Rates%20&%20Regulations/The-Resource-Plan-No-Appendices.pdf

[4] https://www.edockets.state.mn.us/edockets/searchDocuments.do?method=showPoup&documentId={202C2F80-0000-C11A-BA52-EC8AB5636CD4}&documentTitle=20224-184828-0

[5] 18 CFR Sect 1318.500(a)

[6] https://www.whitehouse.gov/briefing-room/presidential-actions/2023/02/16/executive-order-on-further-advancing-racial-equity-and-support-for-underserved-communities-through-the-federal-government/

[7] The key points from this letter are outlined in this blog: https://cleanenergy.org/blog/tva-planning-process-less-public-than-private-utilities/

In addition to the recommendations to the Board in the joint letter, TVA IRP staff can make changes to take action on energy justice. A recent report from the Massachusetts Attorney General's Office, "Overly Impacted & Rarely Heard[8]" can serve as a helpful resource.

Recommendations to the TVA IRP staff include:

- Hire an independent organization to host community engagement meetings. Provide information in a non-technical manner, and then work to translate community input into technical changes to the IRP
- The TVA IRP staff should recognize the value of lived experience by considering public comments and non-technical expert testimony in the IRP process.
- In the absence of a more public process outlined in the joint comments, TVA should ensure that community based organizations and energy justice organizations have a meaningful seat on the IRP working group.
- Develop a Community Benefits Committee to advise the IRP team on how modeling and other IRP decisions may impact underserved communities.
- Include equity in each chapter of the final IRP, as well as dedicate a chapter to TVA's definition, approach to, and learning on how equity applies to its IRP process.

The Role of Distributed Energy Resources

Distributed energy resources (DER) like rooftop and community solar, residential battery storage, and load shifting can play a significant role in TVA's energy future. The benefits of DERs include:

- DERs are connected to the distribution grid and therefore bypass the lengthy, costly and sometimes constrained transmission interconnection process.
- DERs have lower line loss than transmission level assets.
- DERs contribute to resilience by increasing local generation capabilities.
- In many cases, DER loads can be purposefully shaped to provide maximum grid and/or ratepayer value.
- DERs are low- to no- carbon impact technologies.
- DERs have lower land use impact than utility scale generation.
- DER's are key to many communities' vision of energy justice.

While TVA primarily acts as a wholesale generation and transmission provider, TVA has significant influence over the proliferation of DERs through the TVA's relationship with the Local Power Companies (LPC). Vote Solar strongly encourages the TVA IRP team to consider the expansion of LPC self generation and other options for direct to customer DER programs as a resource within the upcoming IRP.

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[8] https://www.mass.gov/doc/overly-impacted-and-rarely-heard-incorporating-community-voices-into-massachusetts-energy-regulatory-processes-swg-report/download

Recommendations to TVA IRP staff:

- Model distributed solar, storage, energy efficiency, demand response, and virtual power plants as a selectable supply side asset. Do not model DERs as a decrement to forecasted load.
- Consider the financial risk mitigations benefits of investing in DERs as opposed to large centralized power plants.
- Work with stakeholders to find and use the most up to date cost and methodology assumptions for DER technologies.
- Share modeling inputs and assumptions with stakeholders willing to sign an NDA. Do so well enough in advance that stakeholders can perform their own alternative modeling to ensure a robust IRP modeling end product.
- Consider the energy and capacity impacts of allowing for greater self generation of the lower power companies.

Thank you for your consideration,

Jake Duncan
Southeast Regulatory Director
Vote Solar

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#21]
Date:	Friday, June 30, 2023 9:48:56 PM

Name	Philip Drope
City	Ocoee
State	TN
Organization	Individual
Email	
Phone Number	

Please provide your comments by uploading a file or by entering them below. *

I believe TVA should use all energy sources available. Fossil fuels, natural gas in particular, should continue be a significant source and nuclear should be dramatically increased as a source for generation to support the baseload demand to avoid future brownouts and blackouts such as occurred last fall. As a scientist, I do not accept the hypotheses (the current models of which have not proven to be true for many years) that rising carbon dioxide levels will cause a climate catastrophe for several reasons. One reason is as carbon dioxide levels rise the warming effects are nonlinear (i.e., as carbon dioxide levels rise, they cause less and less effect on temperature). The current proposed IRP is based upon zero carbon emissions by 2050. The carbon reduction targets are economically unwise and scientifically unnecessary. It would be helpful to have more flexibility in the timeline of the process of carbon reductions. Ratepayers and taxpayers are the ones paying the massive cost you are contemplating using the methods and timelines you are currently proposing, based upon a yet unproven theory. Wind and solar are fine as a supplement to other sources of power but cannot be relied upon as a baseload power source because of their intermittent nature. Even with battery backup they have questionable application as a reliable baseload power source. As I understand your mission, it is to maintain a reliable source of electrical power for the Tennessee Valley at the lowest cost possible now and in the future. Some estimates are that the United States has 100+ years of natural gas supplies, even without further exploration, which could easily double that amount within a few years. I believe we could rely on natural gas, hydropower, and nuclear as our baseload power sources for the rest of this century while we improve the efficiency of alternative energy sources and potentially add new energy sources such as hydrogen or sources we do not even know about today.

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#22]
Date:	Monday, July 3, 2023 9:11:42 AM

Name	Daniel Joranko
City	Nashville
State	TN
Organization	Tennessee Interfaith Power and Light
Email	
Phone Number	

Please provide your comments by uploading a file or by entering them below. *

Global warming poses a major and potentially existential threat to humanity. We at Tennessee Interfaith Power and Light represent religious traditions that emphasize the common good, care for the Earth, and a particular concern for the poor and vulnerable. Therefore, we strongly prefer carbon neutral approaches to energy generation. Given the world's limited carbon budget it is critical that TVA move as rapidly as possible to carbon neutrality.

Since the previous IRP, TVA has commendably committed to firm decarbonization goals and aspirations. In developing future scenarios, we feel it is important that "faster and further" scenarios be included. This will enable TVA to do advanced planning to take advantage of opportunities as they arise, particularly regarding renewables and energy efficiency. Furthermore, we believe that TVA should emphasize energy efficiency and demand response. We also urge TVA to work to maximize Inflation Reduction Act investment in the Valley service area, and incorporate this maximization in the IRP. Finally, we urge TVA to deepen its commitment to reducing low-income energy household burdens, particularly through weatherization and other efficiency measures.

TVA should also incorporate robust public participation and stakeholder engagement, including public meetings throughout the region.

Utilities across the nation are faced with the urgent task of decarbonization. It is our hope that the considerable talent and expertise embedded within TVA will be fully engaged in rising to this challenge.

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#23]
Date:	Monday, July 3, 2023 10:13:35 AM

Name	Simon Mahan
City	Little Rock
State	AR
Organization	Southern Renewable Energy Association
Email	
Phone Number	
Please provide your comments by uploading a file or by entering them below. *	Please see attached set of comments.
Upload File #1	fsrea_comments_tva_irp_scoping_7.3.23.pdf 1.82 MB · PDF

Southern Renewable Energy Association Scoping Comments Tennessee Valley Authority 2024 IRP

Summer 2023

srea
SouthernRenewable.org
Southern Renewable Energy Association

OVERVIEW

Renewable energy demand is growing. Renewable energy prices have plummeted over the past few years. Wind power and solar power prices have declined by 70-90% over the past decade. In many parts of the country, renewable energy is now cost competitive against traditional energy resources. Corporations and other non-utility buyers are finding innovative mechanisms to directly invest in renewable energy. These voluntary announcements are due to the low costs of renewable energy. Even with recent inflationary effects across the economy, renewable energy resources can provide significant cost savings compared to alternatives.

The Tennessee Valley Authority (TVA) has been a leader in purchasing renewable energy. In 2004, the Buffalo Mountain wind project in Tennessee became the south's first utility-scale wind farm, with TVA as its energy customer. In 2010, the TVA Board of Directors "authorized the purchase of as much as 2,000 MW of renewable and clean energy. TVA plans to have half of its power supply from clean and renewable energy sources by 2020."[1] As part of that plan, TVA procured over 1,500 megawatts of wind power. More recently, TVA issued a solicitation for new clean energy resources, where the Company will transact on some 6,000 megawatts (MWs) of new resources. TVA should be applauded for its efforts and encouraged to continue its commitment to renewable energy expansion. With advancements in long duration storage, such as 100-hour batteries, and TVA's plans to expand pumped hydro, SREA encourages TVA to consider renewable expansion even beyond its 10,0000 MW goal.

The Southern Renewable Energy Association (SREA) has been involved in TVA's 2015 IRP, 2019 IRP and now this 2024 IRP. SREA is eager to work with TVA to ensure IRP modeling data and methodologies are reflective of current market offerings.

I. Generation Technology Assumptions

The National Renewable Energy Lab (NREL) publishes its Annual Technology Baseline (ATB) dataset which includes nearly all data input assumptions necessary for most commercially available generation technologies. The NREL ATB is perhaps the most complete dataset regarding new generation resources. NREL recently published its latest version of the ATB, which includes additional data including "the addition of bespoke wind plants, updated PV modeling, tax credit assumptions from the IRA, CCS retrofits, and other updates to cost and performance data for electricity technologies." SREA recommends that TVA use the latest NREL ATB data available for all generation resources including wind energy, solar energy, battery storage (including 2-hour and 4-hour options), hybrid projects (solar plus storage), hydrogen-based resources, and other carbon-free resources. Importantly, the ATB includes a robust methodology regarding inclusion of the Inflation Reduction Act (IRA) for various technologies. NREL is hosting a webinar on July 24, 2023, to discuss the latest ATB.[2]

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[1] Federal Register (February 4, 2010). "Environmental Assessment or Environmental Impact Statement for Purchase of Renewable Energy From CPV Ashley Wind Power Project in North Dakota," Notice by the Tennessee Valley Authority. [https://www.federalregister.gov/documents/2010/02/04/2010-2377/environmental-assessment-or-environmental-impact-statement-for-purchase-of-renewable-energy-from-cpv]

[2] National Renewable Energy Lab (June 2023). 2023 Electricity ATB Launch Webinar. [https://nrel.zoomgov.com/webinar/register/WN_CNeZ4sa-TwC9JyLfxbh0qg?utm_source=Annual+Technology+Baseline+%28ATB%29&utm_campaign=1bd65f5ac7-

Recommended NREL ATB Data Inputs

	2025	2030	2035	2040	2045	2050
In-Region Wind						
Capex ($/kW)	$1,270	$1,190	$1,133	$1,077	$1,021	$ 964
Capacity Factor	33.8%	35.1%	35.2%	35.4%	35.5%	35.6%
LCOE	$28.28	$24.47	$22.57	$20.68	$25.54	$29.41
MISO North Wind						
Capex ($/kW)	$1,195	$1,083	$1,030	$ 977	$ 923	$ 870
Capacity Factor	45.8%	47.5%	47.7%	47.9%	48.1%	48.3%
LCOE	$12.69	$9.31	$8.05	$6.79	$13.27	$18.77
HVDC Wind						
Capex ($/kW)	$1,195	$1,083	$1,030	$ 977	$ 923	$ 870
Capacity Factor	52.8%	56.7%	56.9%	57.2%	57.4%	57.7%
LCOE	$ 9.42	$6.37	$5.23	$4.10	$10.92	$16.75
Utility-Scale Solar						
Capex ($/kW)	$1,204	$1,002	$ 800	$ 737	$ 674	$ 610
Capacity Factor	26.0%	26.6%	27.2%	27.4%	27.7%	27.9%
LCOE	$27.67	$20.18	$12.92	$10.68	$15.85	$20.42
Solar Plus Battery						
Capex ($/kW)	$2,437	$2,036	$1,764	$1,620	$1,476	$1,332
Capacity Factor	30%	31%	31%	32%	32%	32%
LCOE	$69.10	$59.43	$52.22	$49.36	$51.08	$51.41
Battery - 2 Hour Capex ($/kW)	$ 862	$ 749	$ 697	$ 646	$ 594	$ 541
Battery - 4 Hour Capex ($/kW)	$1,436	$1,204	$1,111	$1,018	$ 925	$ 833

Source: NREL ATB 2023[3], Market Financial Case[4]

TVA recently received a significant number of project proposals due to its solicitation of 5,000 megawatts (MW) of clean energy resources. TVA has announced plans to transact on 6,000 MW of resources received from that solicitation.[5] TVA should be lauded for this effort, especially because the

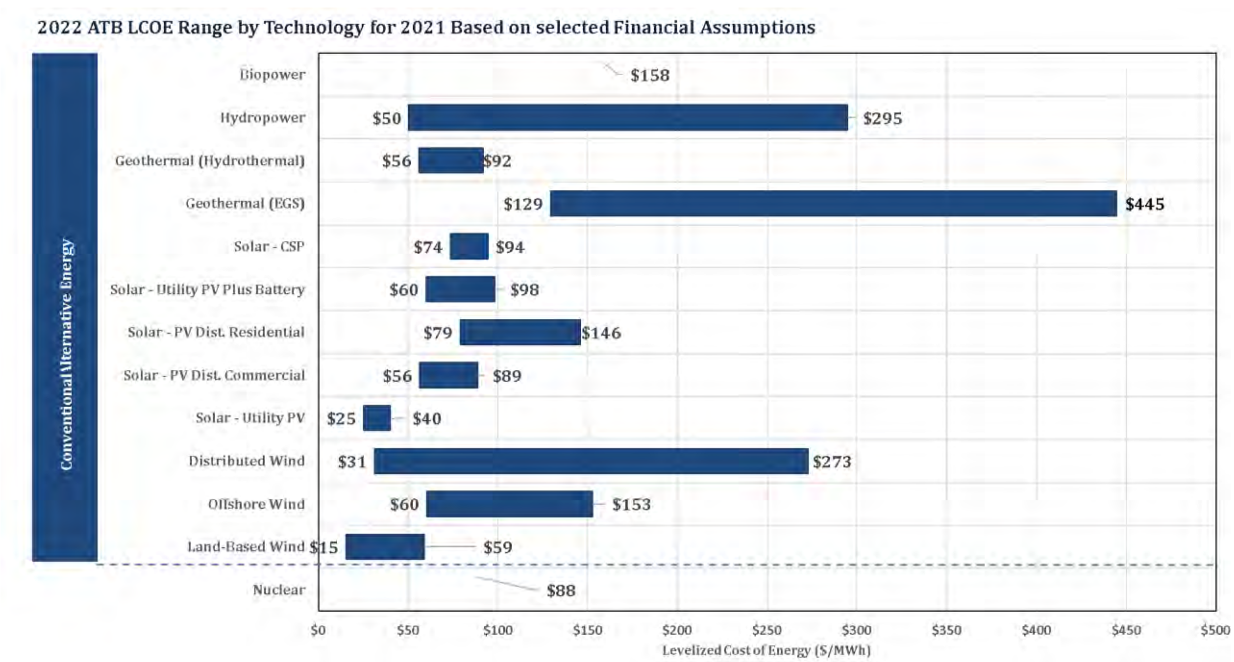
EMAIL_ANALYSIS_SS_2019_12_18_COPY_01&utm_medium=email&utm_term=0_c7415174ea-1bd65f5ac7-289679302]

[3] 2023 Annual Technology Baseline (ATB) Cost and Performance Data for Electricity Generation Technologies [https://data.openei.org/submissions/5865]

[4] Recommended data are recommended by SREA for TVA's region. All technologies represent NREL ATB's "moderate" cases. In-Region Wind Land-Based Wind - Class 9 - Technology 3; MISO North Wind Land-Based Wind - Class 4 - Technology 1; HVDC Wind Land-Based Wind - Class 1 - Technology 1; Utility-Scale Solar Utility PV - Class 7; Solar Plus Battery PV+Storage - Class 5

[5] Tennessee Valley Authority (May 10, 2023). TVA Celebrates 90th Anniversary, Outlines Plan to Double Solar Energy Capacity. [https://www.tva.com/newsroom/press-releases/tva-celebrates-90th-anniversary-outlines-plan-to-double-solar-energy-capacity#:~:text=Last%20June%2C%20in%20an%20effort,within%20the%20next%2060%20days.]

2019 IRP called for a similar expansion of renewable resources.[6] While those resources will be valuable data points for inclusion in this IRP, TVA will need to expand its generation technology forecasts for resources beyond the 6 gigawatts (GW) announced. Generation resources that bid into TVA's solicitation were likely already existing in the generation interconnection queue, potentially for years, prior to the call for proposals. As such, this first phase of projects is not necessarily optimized to take full advantage of the IRA, meaning the next phase of project proposals may have improved costs or performance metrics, which will inherently provide reliability and cost benefits for TVA customers. Incorporating the NREL ATB data, while ground-truthing the data with the first phase of projects TVA is awarding bids to, will help ensure this IRP is the most up-to-date and relevant for the Valley. Beyond including assumptions from projects proposed in the TVA solicitation, TVA should incorporate generation technologies it evaluated in the 2019 IRP with updated data, and we encourage TVA to provide the full suite of data for each generation technology, including the levelized cost of energy (LCOE) values.



Source: NREL ATB 2023[7], Market Financial Case

A. Inflation Reduction Act Modeling

The Inflation Reduction Act (IRA) will be a critical component of this IRP. Enacted in August 2022, the IRA includes incentives for both generation and load-side resources that should be incorporated in TVA's analysis.[8] One of the most important components of the IRA includes providing an Investment Tax Credit (ITC) or Production Tax Credit (PTC) for clean energy projects. The base incentive structures are 30% for the ITC, with the possibility of up to a 50% ITC, or $26

[6] Tennessee Valley Authority (2019). 2019 Integrated Resource Plan. [https://www.tva.com/environment/environmental-stewardship/integrated-resource-plan/2019-integrated-resource-plan]

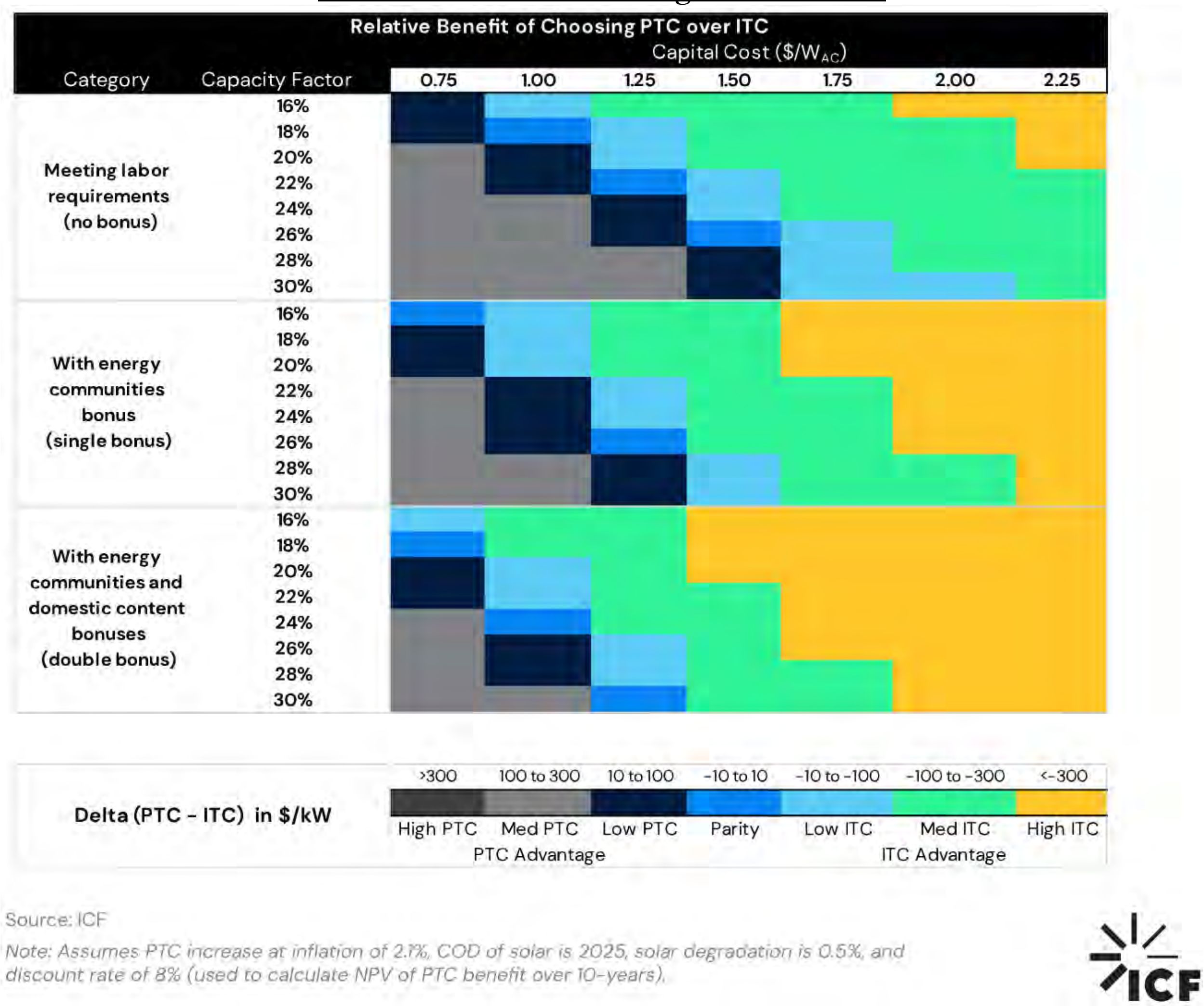
[7] 2023 Annual Technology Baseline (ATB) Cost and Performance Data for Electricity Generation Technologies [https://data.openei.org/submissions/5865]

[8] Lalit Batra, Nishit Pande, Harsha Reddy, Dinesh Madan (December 15, 2022). Solar Economics: The PTC vs. ITC Decision. ICF. [https://www.icf.com/insights/energy/solar-economics-ptc-vs-itc]

per Megawatt Hour (MWh) for the PTC, up to $31/MWh. Domestic Content and Energy Community bonuses enable higher levels of the ITC or PTC. It is highly likely projects that opt for the ITC will be able to achieve up to 40% cost reductions due to the 30% base credit plus either the 10% Domestic Content Bonus or the 10% Energy Community Bonus in the TVA territory. Similarly, projects receiving the PTC will likely be able to achieve a $29/MWh credit. Both credits are now extended through 2033. Stand-alone energy storage resources are also eligible for the ITC.

Some initial analysis (see below chart) suggests that the PTC will be the credit of choice for wind energy projects so long as capital expenditure costs are relatively low, and capacity factors are relatively high. Meanwhile, projects with higher capital costs with relatively lower capacity factors may favor the ITC, like some solar, battery and hybrid (solar plus storage) projects. As such, TVA should model ITC projects (such as solar, hybrid, and batteries) as receiving at least a 40% credit, and PTC projects (likely wind) receiving a $29/MWh credit.

Relative Benefit of Choosing PTC over ITC



Source: ICF 2022[9]

[9] Lalit Batra, Nishit Pande, Harsha Reddy, Dinesh Madan (December 15, 2022). Solar Economics: The PTC vs. ITC Decision. ICF. [https://www.icf.com/insights/energy/solar-economics-ptc-vs-itc]

Additionally, hydrogen production receives its own credit, which will have the dual effect on IRP modeling of 1) spurring hydrogen production (and thus, increasing the load forecast due to the energy required to produce green hydrogen), and 2) reducing green hydrogen fuel costs for electric generation resources. These incentives are also available for the next decade and should be incorporated in TVA's analyses.

B. Advanced Technologies

Advanced technologies, such as batteries, hydrogen, small modular reactors (SMRs), and carbon capture sequestration (CCS) require additional data assumptions in the IRP modeling efforts. These newer technologies may require different modeling methodology than more typical generation resources. Additional costs and benefits may not fit easily into existing IRP modeling software programs. TVA may be able to better analyze these advanced technologies as sensitivity cases and manual portfolios where the resources are manually added to a base case portfolio. Given the likelihood that the next IRP will occur in the 2027 or 2028 timeframe, it is exceptionally important for TVA to incorporate even near-commercial technology, like 100-hour batteries, in its analyses.

i. Batteries

One of the greatest advantages of battery technology is the ability to ramp quickly. Most IRP software programs focus on hourly dispatch, in part to reduce model run time. However, without adequately evaluating battery storage ramp speed, IRPs may miss key reliability events or economic arbitrage opportunities that batteries may be helpful with. SREA recommends TVA conduct at least one sensitivity or scenario with sub-hourly dispatch where batteries play a prominent role. Further, SREA recommends evaluating 2-hour, 4-hour, 8-hour, and even 100-hour battery options. Finally, SREA recommends incorporating at least one manual portfolio where 1,000 MW/4,000 MWh battery storage resources are added to the system sooner than the model may have chosen to do so on its own. This sort of manual portfolio can create a work-around to model limitations that may not be adequately capturing all the benefits of energy storage.

ii. Hydrogen

As mentioned previously, hydrogen will play dual roles in this IRP: as load growth as well as a generation resource. Hydrogen load growth is likely to occur prior to hydrogen use as a fuel for generation purposes. Proton Exchange Membrane (PEM) electrolysis is likely to be a significant source for "green" hydrogen in the near-term; relying on zero carbon emission generation resources to provide electricity necessary to split molecules. The Southwestern Electric Power Company (SWEPCO) recently published its draft IRP in Louisiana where the company included a discussion of hydrogen resources including cost, performance assumptions, and use cases.[10] SREA recommends including a hydrogen growth scenario where load is increased, and renewable energy resources to serve that new load is added. Hydrogen-based generation should be allowed to be added to the model beginning in 2030. Further, TVA recently announced partnerships to establish the Southeast Hydrogen Hub. SREA recommends TVA incorporate its hydrogen projections in this IRP.

[10] Southwestern Electric Power Company (March 2023). Draft 2023 Integrated Resource Plan Report to the Louisiana Public Service Commission. Pg. 57-60
[https://www.swepco.com/lib/docs/community/projects/2023_SWEPCOIRPDraft.pdf]

iii. Small Modular Reactors/Carbon Capture Sequestration

In TVA's 2019 IRP, TVA included two portfolios where small modular nuclear reactors (SMR) where manually forced into the model for addition. This is a reasonable methodology for a small number of scenarios or sensitivities for both SMRs and Carbon Capture Sequestration. SMRs and CCS, like other technologies, should not be forced into the model runs for all scenarios. Reasonable timeframes for these generation technologies may be in the 2035 timeframe, or beyond. As SMRs are an evolving technology, the IRP should consider associated risks with the deployment of SMRs that would increase projected costs and delay project timelines.

II. <u>Resource Accreditation</u>

Resource accreditation is an exceptionally important component of IRP modeling. Over-estimating capacity value for some resources, like natural gas facilities, will increase model reliance on those units, even when in real time operation, those facilities may not be as readily available. Under-estimating capacity for some resources, like renewable energy resources, will result in an over-building of generation and increase costs.

Over the past several years, the evidence of mis-accrediting resources has significantly increased. With Winter Storm Uri and Winter Storm Elliott, both storms showed that the natural gas fleet is exceptionally vulnerable. At one point during the February 2021 Winter Storm Uri, MISO South had 44% of its installed [gas?] capacity out on unplanned outages.[11] During Winter Storm Elliott, TVA reported it lost ten out of fifteen natural gas power plants at some point during the storm.[12] Four coal-fired power plants also lost the ability to provide generation. The North American Electric Reliability Corporation (NERC) recently published its 2023 State of Reliability report and found that coal unit unavailability is increasing while "…gas-fired generation fleet in recent years has been consistently higher during the winter months. …There are no apparent trends in the unavailability of the other forms of generation."[13]

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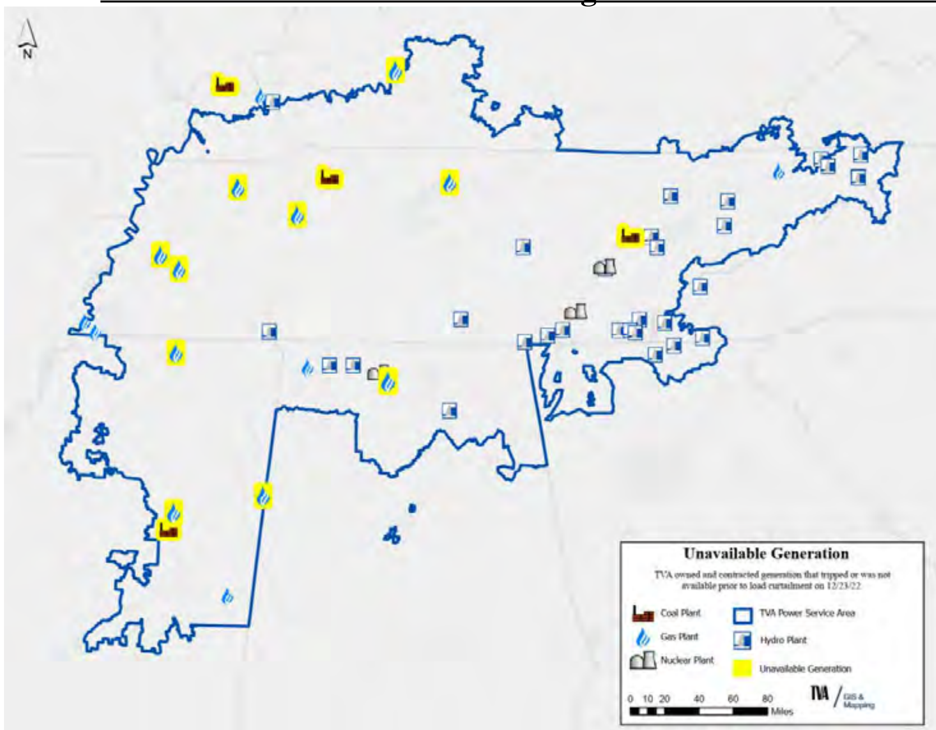
[11] Midcontinent Independent System Operator (March 11, 2021). Overview of February 2021 Arctic Weather, Markets Subcommittee.
[https://cdn.misoenergy.org/20210311%20MSC%20Item%2004%20Max%20Gen%20Feb%2015530356.pdf]

[12] Tennessee Valley Authority (February 2, 2023). Winter Storm Elliott Update, as presented to the Kentucky Legislature.
[https://apps.legislature.ky.gov/CommitteeDocuments/305/24160/Feb%202%202023%20TVA%20PowerPoint.pptx]

[13] North American Electric Reliability Corporation (June 2023). 2023 State of Reliability Overview.
[https://www.nerc.com/pa/RAPA/PA/Performance%20Analysis%20DL/NERC_SOR_2023_Overview.pdf]

<u>TVA Unavailable Generation During Winter Storm Elliott 2022</u>



Source: TVA 2023[14]

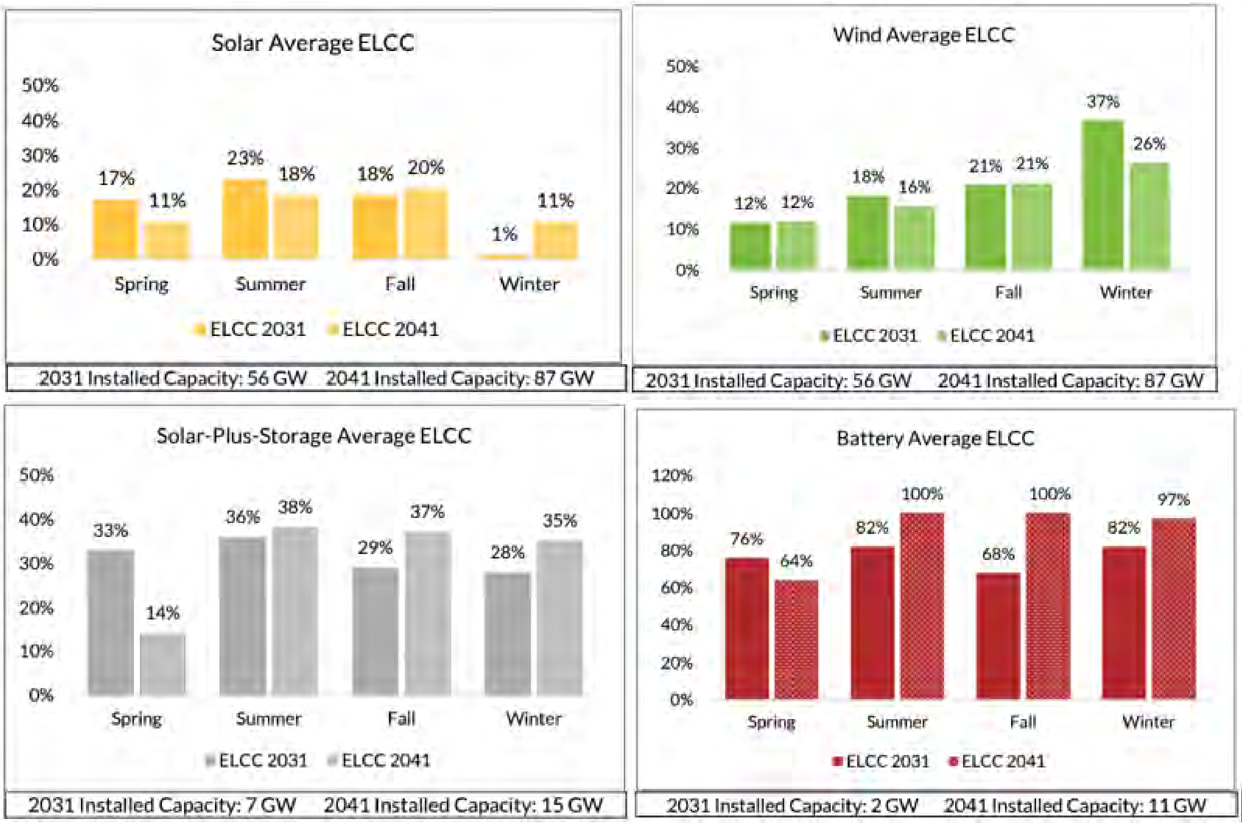
A. <u>Seasonal Accreditation</u>

MISO and other regional transmission organizations are implementing seasonal accreditation methodologies. Instead of just relying on a single summertime peak, which has been industry standard for decades, a seasonal accreditation based on multiple peaks and actual resource operations may do a better job at anticipating resource needs during all times of the year. Seasonal effective load carrying capacity (ELCC) methodologies are more likely to take into consideration actual generation outages, especially during extreme weather events, such as Winter Storm Elliott. As noted in TVA's 2019 IRP, "Since the 2015 IRP, TVA conducted an updated reserve margin study to evaluate seasonal differences in demand and supply and the impact of increasing solar capacity on the system. The objective was to identify discrete reserve margin targets for summer and winter to ensure an industry best-practice level of reliability across both peak seasons."[15] It is unclear if TVA has incorporated differing capacity values for traditional resources during two distinct seasons. If not, TVA should strongly consider incorporating MISO's seasonal accreditation methodologies, and potentially its values.

[14] Tennessee Valley Authority (February 2, 2023). Winter Storm Elliott Update, as presented to the Kentucky Legislature. [https://apps.legislature.ky.gov/CommitteeDocuments/305/24160/Feb%202%202023%20TVA%20PowerPoint.pptx]

[15] Tennessee Valley Authority (2019). TVA 2019 IRP, pg. 1-5. [https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/irp/2019-documents/tva-2019-integrated-resource-plan-volume-i-final-resource-plan.pdf]

MISO Seasonal Accreditation for Renewable Resources



Source: MISO 2022[16]

B. Thermal Accreditation

As mentioned previously, thermal generation has underperformed compared to historical capacity accreditation values over the past several years. MISO's seasonal accreditation process includes new assumptions for a number of natural gas, coal, and other "conventional" generation resources. However, MISO's values do not necessarily take into consideration firm gas pipeline capacity or contracts. With Winter Storm Elliott and Uri, firm natural gas pipeline capacity was necessary to provide fuel to natural gas generators. Without firm fuel contracts, in peak conditions, natural gas generators effectively become weather dependent. SREA recommends TVA should evaluate MISO's seasonal accreditation methodology and run at least one sensitivity where thermal generation resources are provided a capacity value in line with historical operations, especially during the recent extreme weather events. Further, SREA recommends TVA incorporate the additional costs associated with providing firm natural gas contracts for all seasons in the natural gas fuel forecast.

[16] Midcontinent Independent System Operator (November 2022). 2022 Regional Resource Assessment. [https://cdn.misoenergy.org/2022%20Regional%20Resource%20Assessment%20Report627163.pdf]

MISO Generation Class Average Accreditation

Row Labels	Summer ISAC/ICAP	Fall ISAC/ICAP	Winter ISAC/ICAP	Spring ISAC/ICAP	Count of Units
Combined Cycle	89.5%	83.8%	83.9%	81.2%	108
Combustion Turbine 0-20MW	83.3%	82.9%	76.8%	79.8%	40
Combustion Turbine 20-50MW	89.2%	86.0%	82.3%	85.1%	115
Combustion Turbine 50+MW	92.2%	84.8%	81.9%	86.9%	174
Diesels	89.9%	86.9%	84.5%	86.8%	70
Fluidized Bed Combustion	[redacted]	[redacted]	[redacted]	[redacted]	8
Fossil Steam 0-100MW	82.0%	81.2%	78.0%	76.2%	54
Fossil Steam 100-200MW	[redacted]	[redacted]	[redacted]	[redacted]	28
Fossil Steam 200-400MW	84.6%	79.7%	77.1%	76.9%	33
Fossil Steam 400-600MW	81.2%	78.1%	81.1%	77.5%	31
Fossil Steam 600-800MW	[redacted]	[redacted]	[redacted]	[redacted]	24
Fossil Steam 800+MW	[redacted]	[redacted]	[redacted]	[redacted]	6
Hydro 0-30MW	[redacted]	[redacted]	[redacted]	[redacted]	14
Hydro 30+MW	[redacted]	[redacted]	[redacted]	[redacted]	8
Nuclear	[redacted]	[redacted]	[redacted]	[redacted]	17
FleetWide Schedule 53 ISAC/ICAP	87.4%	83.2%	81.3%	82.2%	730

Source: MISO 2023[17]

Alongside resource accreditation methodology, capacity-based planning methodologies should also be scrutinized. Relying solely on capacity expansion models likely will miss true system optimization opportunities, particularly around energy cost savings. SREA provided our concerns regarding capacity-first (or capacity-only) planning practices in the 2019 TVA IRP process. In that process, TVA explained that, "The development of resource portfolios was a two-step process. First, an optimized portfolio, or capacity plan, was generated, followed by a detailed financial analysis. This process was repeated for each strategy/scenario combination and for additional sensitivity runs." Taken to the extreme, a capacity-only planning process could lead to unusual model results that recommend significant power generation development or legacy generation retention that are rarely used, at the expense of low-cost energy options. This outcome appears to have occurred in the 2019 IRP. Capacity-focused planning does not initially address economic costs; alternatively, an energy-based financial dispatch model would efficiently dispatch necessary resources. TVA should evaluate energy planning options, not just capacity.

III. Transmission Planning

Transmission planning needs to be improved in this IRP. Historically, TVA IRPs have not heavily discussed transmission plans and needs. For instance, in the 2019 IRP, TVA included "generic transmission upgrade costs"[18] as a component of generation resource cost and performance estimates; however, to our knowledge, those data were never made available to stakeholders for discussion or vetting. Import and export constraints for firm power purchases from neighboring systems were also imposed in the model.[19] In the 2019 IRP Environmental Impact Statement document, TVA's Table 5-2 includes generic impacts of transmission system construction activities.[20] However, the IRP rarely

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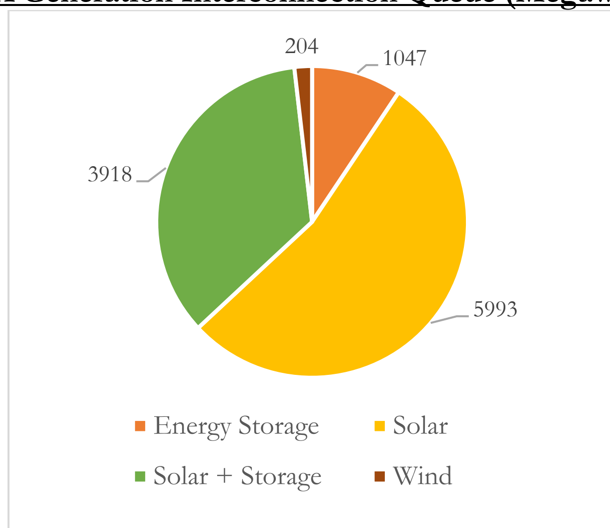
17 Midcontinent Independent System Operator (2023). Planning Year 2023-2024 Schedule 53 Class Averages. [https://cdn.misoenergy.org/20230328%20Schedule%2053%20Class%20Average_Posted627347.pdf]
18 Tennessee Valley Authority 2019 Integrated Resource Plan, pg. A-6.
19 Tennessee Valley Authority 2019 Integrated Resource Plan, pg. D-2.
20 Tennessee Valley Authority 2019 Integrated Resource Plan, Environmental Impact Statement. [https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-

discusses the benefits of transmission or ways to calculate the value of additional transmission. Aging transmission infrastructure, some over 50 years old[21], will eventually need to be replaced and early integrated transmission planning practices can identify multiple values of various transmission projects. Properly calculating transmission benefits may require additional methodologies that have not yet been used by TVA, but that have been developed in other regions.

1. Generation Interconnection

TVA typically incorporates generator interconnection transmission analyses in its normal NEPA process for individual generators. For its IRP, TVA includes some generic interconnection costs associated with new generation. Currently, there are approximately 11 gigawatts (GW) of renewable generation resources active in the TVA queue.[22] Nearly 6 GW of the queue resources are solar energy, followed by nearly 4 GW of solar plus storage, then about 1 GW of stand-alone batteries, with one 204 MW wind project. Those resources are all located in Tennessee (4.4 GW), Mississippi (3.2 GW), Alabama (2.7 GW), and Kentucky (0.8 GW).

TVA Generation Interconnection Queue (Megawatts)



content/environment/environmental-stewardship/irp/2019-documents/tva-2019-integrated-resource-plan-volume-ii-final-eis.pdf]

[21] Tennessee Valley Authority (2023). Existing Transmission Assets in Tennessee Programmatic Agreement. [https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/environment/environmental-stewardship/programmatic-agreement.pdf]

[22] Tennessee Valley Authority (May 1, 2023). Current Generator Interconnection Queue. [https://www.oasis.oati.com/woa/docs/TVA/TVAdocs/OASIS_CurrentQueue.pdf]

TVA Active Renewable Energy Generator Interconnection Queue 2023

	Solar	Solar+Storage	Storage	Wind
Alabama	1,827	720	200	
Kentucky	800		25	
Mississippi	1,154	1,631	400	
Tennessee	2,212	1,567	422	204
Total	5,993	3,918	1,047	204

Source: TVA Generator Interconnection Queue 2023[23]

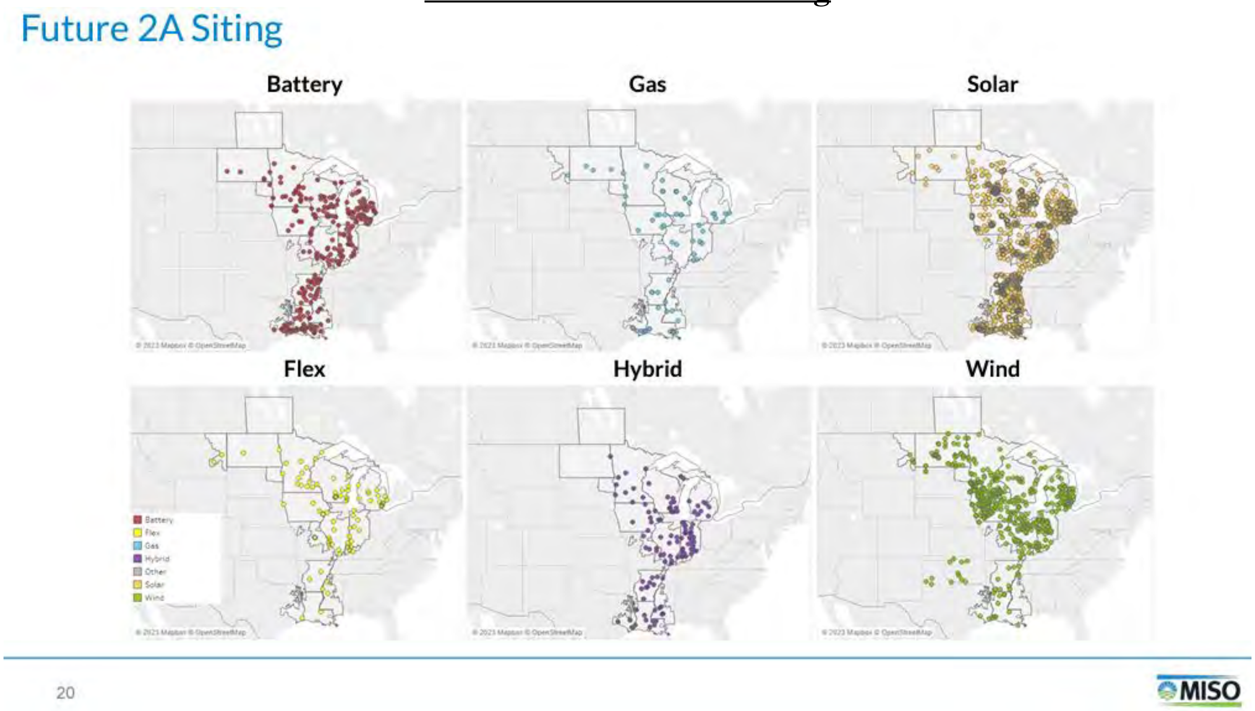
While not all generation projects listed in the queue will get constructed, TVA has already noted a desire to add approximately 10,000 MW of new solar resources by 2035.[24] In the Southeast (including TVA), queue project success rate is about 10% on a capacity-weighted basis.[25] Queue success rates in other regions of the country range from about 10% to about 25%. If the queue success rate holds, TVA would need 40-100 GW of solar resources in its queue to fulfill its 10 GW goal, or as much as almost ten-times as much capacity than currently being evaluated.

Improved transmission planning can reduce queue study periods, expedite project construction, and reduce overall system costs.[26] The Midcontinent Independent System Operator's (MISO) Long Range Transmission Planning (LRTP) process uses its queue as a data input to optimize transmission planning.[27] MISO describes its process in its Futures Report as follows:

> [Wind and Solar PV] were modeled as a collector system, representing an aggregated capacity potential that can be installed within 10-30 miles of each site. These collector sites were identified by two methods:
>
> 1. Compilation of Generation Interconnection (GI) queue projects: 80% of Future-determined capacity was distributed to GI sites. GI projects were ranked based on GI queue status (projects further along in the GI study process were ranked higher) and grouped by project state location, creating a capacity by state penetration percentage. GI projects within 10 miles of each other were identified and combined into a collector system. The capacity by state penetration percentage was applied to the 80% capacity expansion results, creating a state-up siting processes driven by GI Queue activity.
>
> 2. Vibrant Clean Energy (VCE) results: VCE sites receive the remaining 20% of Future-determined capacity. Collector buses represent a 20- to 30-mile aggregated capacity potential.

[23] Ibid.
[24] Tennessee Valley Authority (May 10, 2023). TVA Celebrates 90th Anniversary, Outlines Plan to Double Solar Energy Capacity. [https://www.tva.com/newsroom/press-releases/tva-celebrates-90th-anniversary-outlines-plan-to-double-solar-energy-capacity]
[25] Lawrence Berkeley National Lab (April 2023). Queued Up: Characteristics of Power Plants Seeking Transmission Interconnection As of the End of 2022 [https://emp.lbl.gov/sites/default/files/queued_up_2022_04-06-2023.pdf]
[26] Johannes Pfeifenberger et al (October 2021). Transmission Planning for the 21st Century: Proven Practices that Increase Value and Reduce Costs. [www.brattle.com/wp-content/uploads/2021/10/Transmission-Planning-for-the-21st-Century-Proven-Practices-that-Increase-Value-and-Reduce-Costs.pdf]
[27] Midcontinent Independent System Operator (December 2021). MISO Futures Report. [https://cdn.misoenergy.org/MISO%20Futures%20Report538224.pdf]

MISO LRTP Future 2A Siting



Source: MISO 2023[28]

Separately, Duke Energy Carolinas/Progress have developed its "Red Zone" mapping project for generator interconnection. A Red Zone area is an area "where there is congestion of MW resource/load which will require upgrade. Upgrades in a Red Zone would likely be extensive."[29] Duke provides the map as a service to potential generators, forewarning developers of potential high interconnection costs as well as encouraging project development in relatively lower cost areas. In addition to providing transmission topology transparency, Duke is working to alleviate Red Zone areas by expanding transmission.

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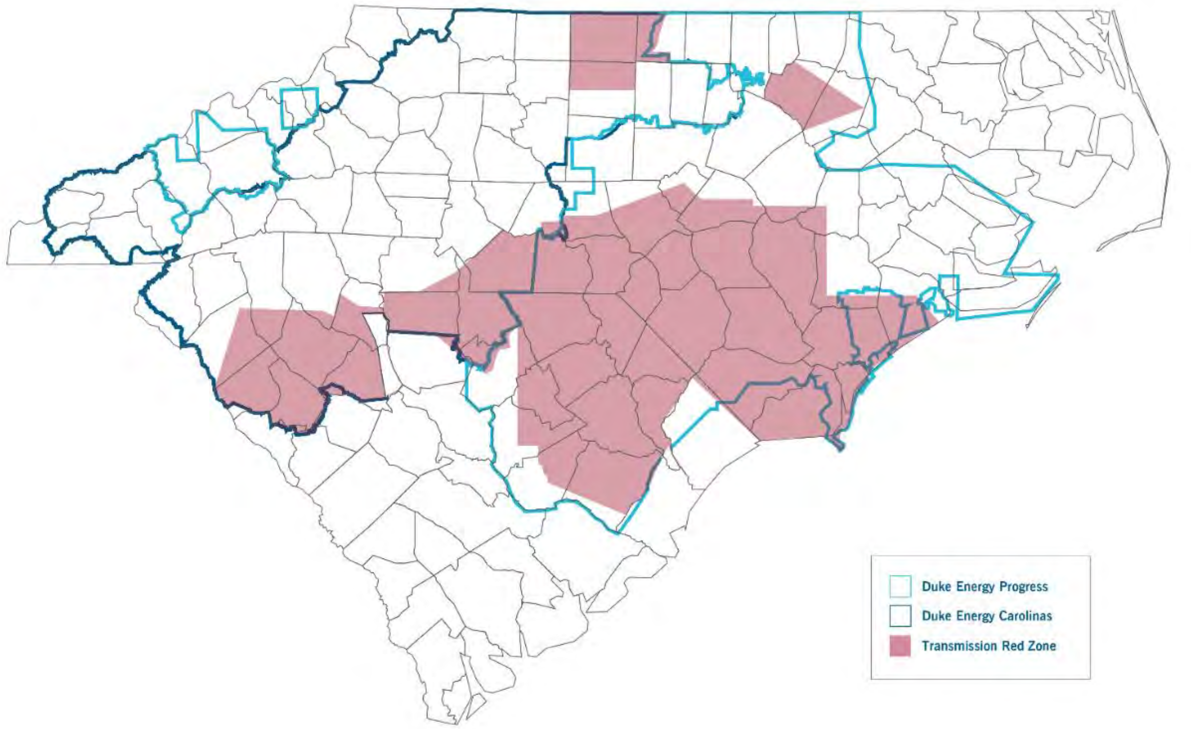
[28] Ibid.

[29] Great Plains Institute (March 16, 2023). Duke Energy's 2023 Carolinas Resource Plan Stakeholder Meeting. [https://p-cd.duke-energy.com/-/media/pdfs/carolinas-irp-support/carolinas-resource-plan-mtg-2-summary.pdf?rev=227f6399d7454a628cd457c5c74650d7]

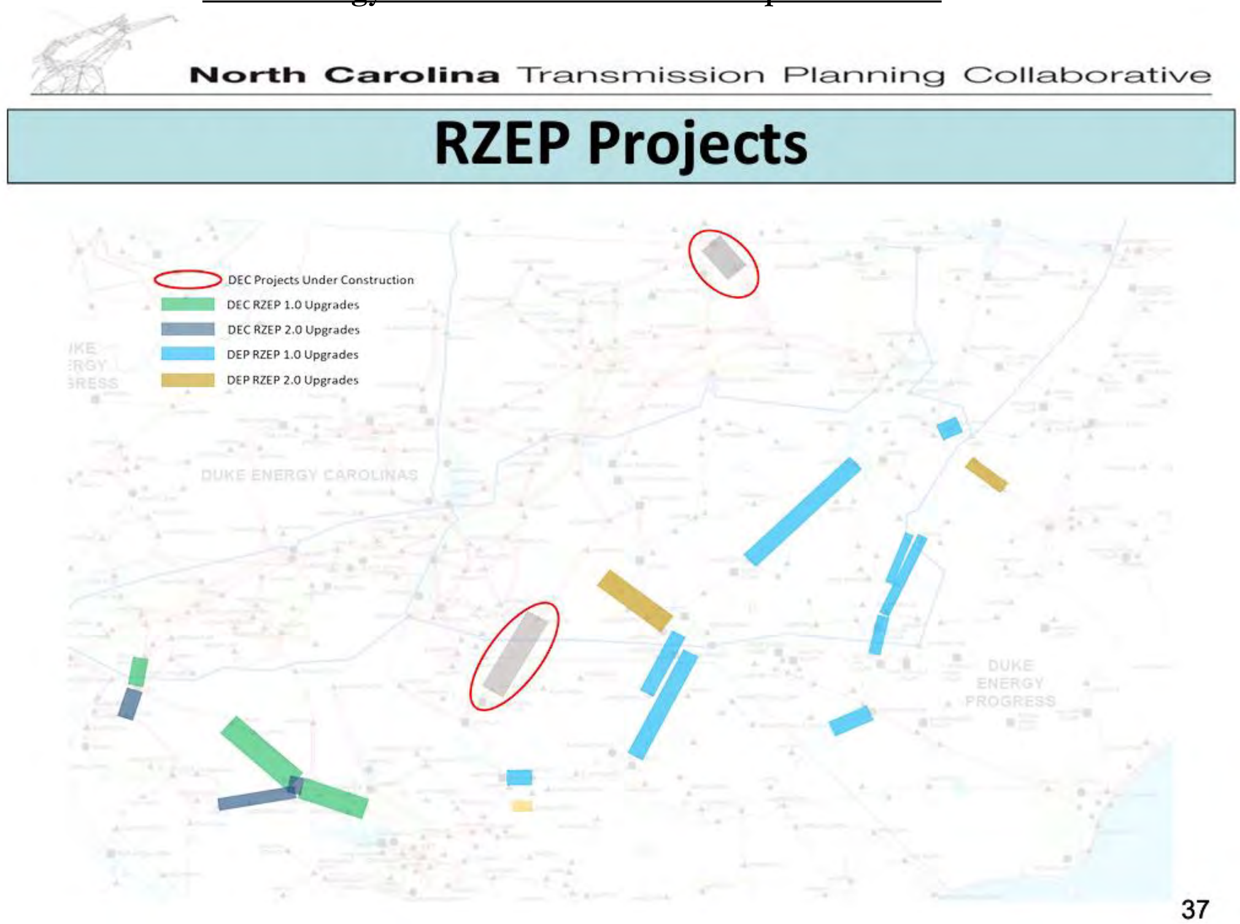
Duke Energy Transmission Red Zone



Source : Duke Energy 2022[30]

[30] Duke Energy (2022). DEP DEC Generator Interconnection Requirements and Locational Guidance. [https://www.oasis.oati.com/woa/docs/DUK/DUKdocs/DEP-DEC_Generator_Interconnection_Requirements_and_Locational_Guidance_05-2022.pdf]

Duke Energy Red Zone Transmission Expansion Plan

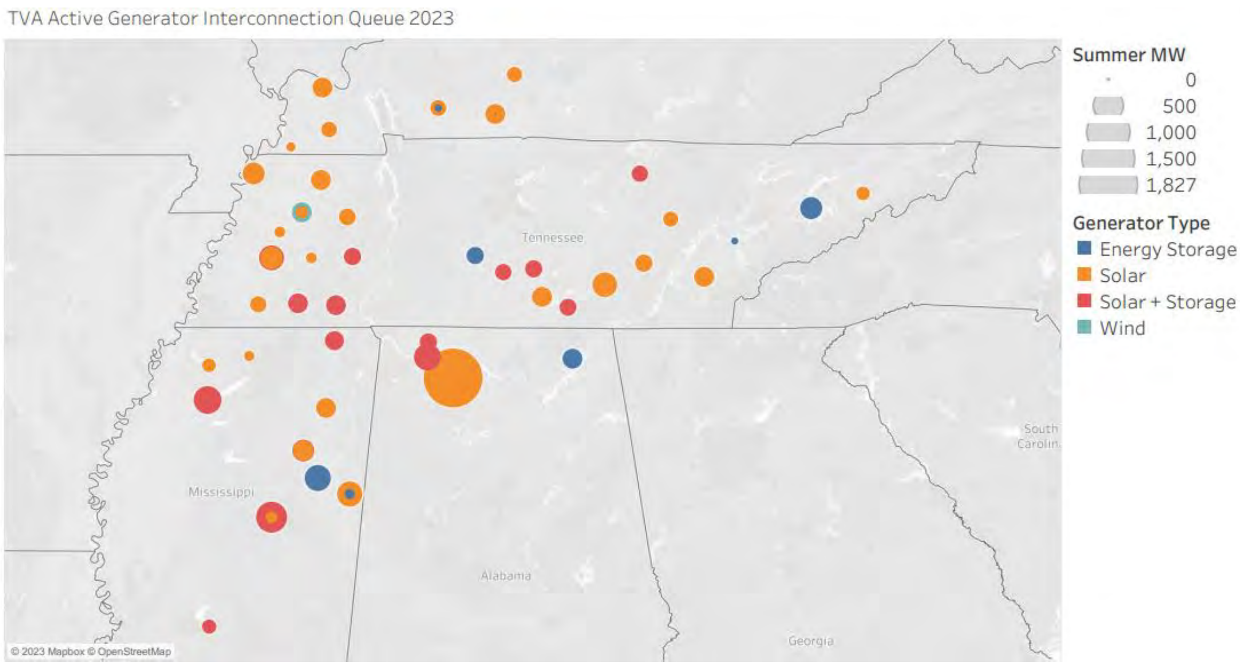


Source: Duke Energy 2023[31]

TVA can borrow methodologies from both the MISO LRTP and Duke Energy Red Zone analyses for this IRP. First, by incorporating the generator interconnection data, TVA can better identify likely locations for transmission upgrades. Second, TVA should provide data publicly for potential developers to improve transparency and reduce the likelihood of overburdening the queue. Finally, TVA can proactively plan transmission upgrades based on likely generator and potentially load growth. Those plans and data should be incorporated in the IRP to optimize both transmission and generation.

[31] North Carolina Transmission Planning Collaborative (June 21, 2023). TAG Meeting. [http://www.nctpc.org/nctpc/document/TAG/2023-06-21/M_Mat/TAG_Meeting_Presentation_for_06-21_2023_FINAL.pdf]

TVA Active Renewable Energy Generator Interconnection Queue 2023



Source: TVA Generator Interconnection Queue, SREA 2023[32]

2. Transmission Expansion

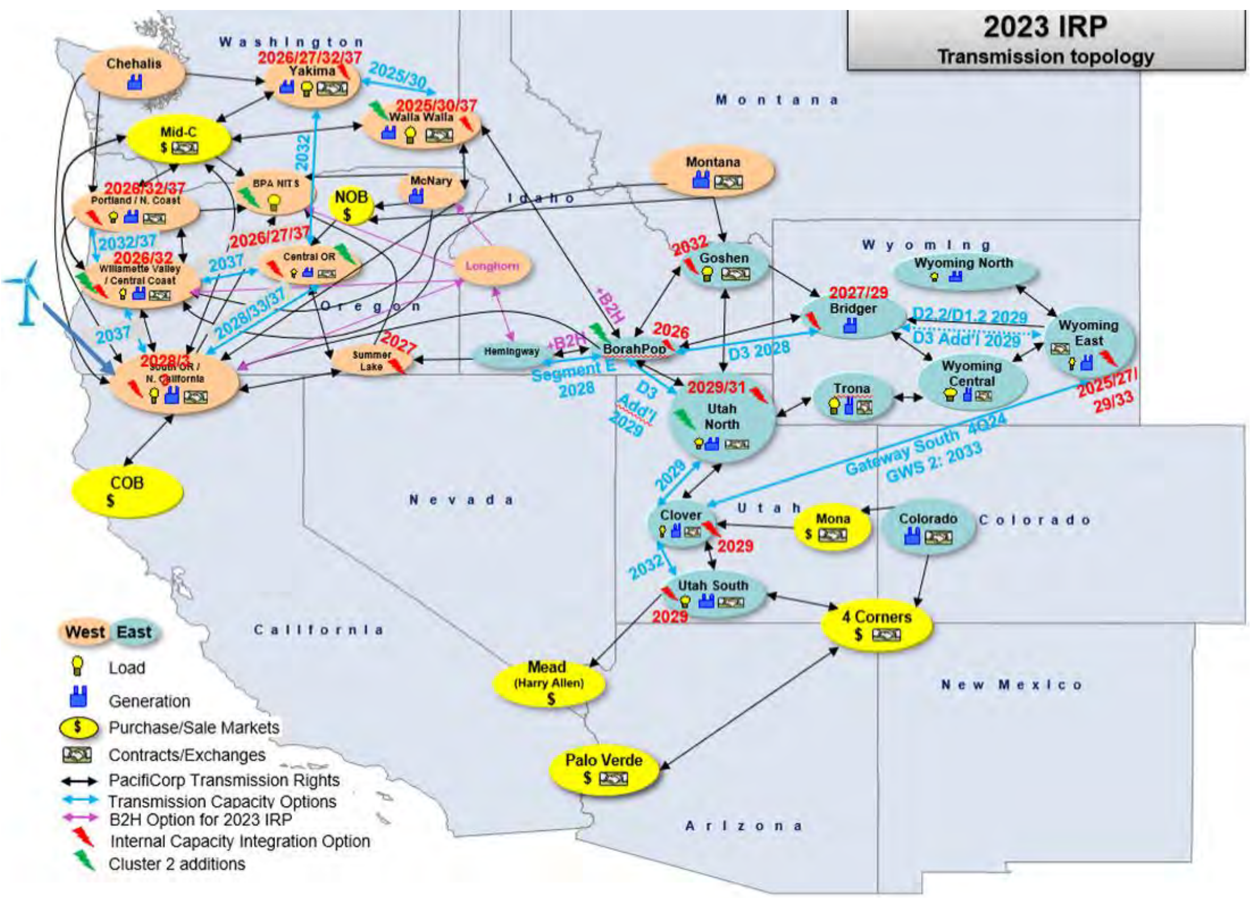
For non-generator interconnection transmission projects, TVA posts some of its current system projects[33] and includes information and stakeholder engagement opportunities for each project. Many recent projects are based on new load growth[34], generator retirements[35], reliability[36], and increasing import capability.[37] Not all transmission projects are posted on TVA's website. For instance, the Alcoa - Nixon is a 161kV transmission project slated for a 2025 in-service date, based on TVA submission to the Southeastern Regional Transmission Planning (SERTP) process, but is not currently included on the TVA website.[38]

Similar to MISO, PacifiCorp combines generation and transmission for its planning purposes. In its most recent IRP, PacifiCorp described its transmission modeling process. That company relies

[32] Tennessee Valley Authority (May 2023). Current Generator Interconnection Queue. [https://www.oasis.oati.com/woa/docs/TVA/TVAdocs/OASIS_CurrentQueue.pdf]
[33] https://www.tva.com/energy/transmission/transmission-system-projects
[34] https://www.tva.com/energy/transmission/transmission-projects/columbia-tennessee-(fiberon)
[35] https://www.tva.com/energy/transmission/transmission-projects/anderson-substation-(oak-ridge)
[36] https://www.tva.com/energy/transmission/transmission-projects/olive-branch-mississippi-(mineral-wells-west-pleasant-hill)
[37] https://www.tva.com/energy/transmission/transmission-projects/tiptonville-tennessee-(tiptonville-new-madrid-no.-2)
[38] Southeast Regional Transmission Planning (June 29, 2023). 2023 SERTP Preliminary Expansion Plan Non-CEII Report [http://www.southeasternrtp.com/docs/general/2023/2023_SERTP_Preliminary_Expansion_Plan_Non-CEII_Report.pdf]

on Plexos software to co-optimize generation additions, retirements, and transmission additions.[39] PacifiCorp notes Plexos includes several advantages such as "endogenous transmission" planning where there is no "complex topology additions or analytics", no "need to create multiple copies of every resource" and multiple "paths can be modeled as one option".[40] PacifiCorp creates "bubbles" of clustered load and proxy generation areas across its service territory. TVA may be able to replicate this process using EnCompass software; however, if not, TVA should consider supplementing its efforts with partners that have Plexos experience.

<u>PacifiCorp 2023 IRP Transmission System Model Topology with Options</u>



Source: PacifiCorp 2023[41]

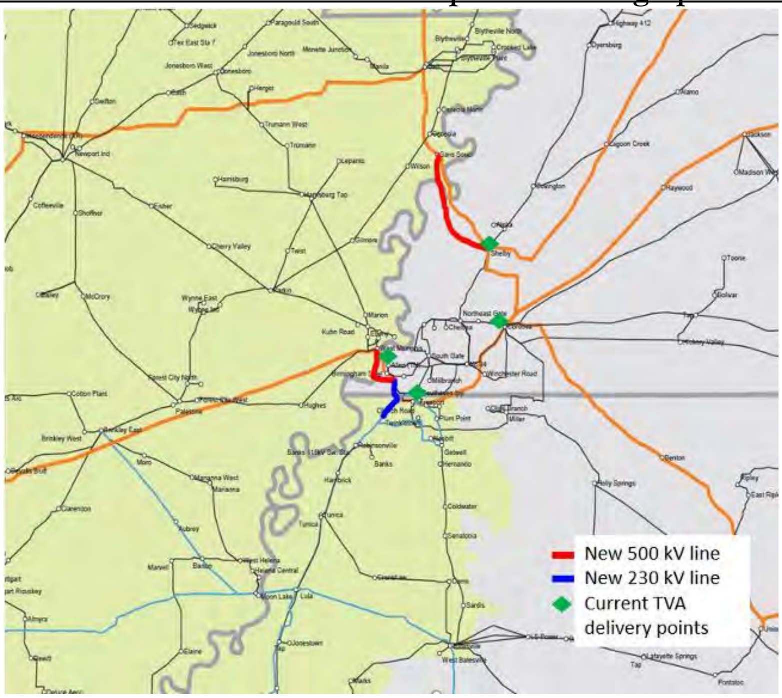
[39] PacifiCorp (May 31, 2023). 2023 Integrated Resource Plan (Amended Final). Chapter 4. Transmission. https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/energy/integrated-resource-plan/2023-irp/2023_IRP_Volume_I_Final_5-31-23.pdf

[40] PacifiCorp (April 7, 2022). Integrated Resource Plan 2023 IRP Public Input Meeting. [https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/energy/integrated-resource-plan/2023-irp/PacifiCorp_2023_IRP_PIM_April_7_2022.pdf]

[41] PacifiCorp (May 31, 2023). 2023 Integrated Resource Plan (Amended Final) Figure 8.3. [https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/energy/integrated-resource-plan/2023-irp/2023_IRP_Volume_I_Final_5-31-23.pdf]

In its 2020 IRP, Memphis Light Gas & Water evaluated joining the MISO market.[42] MLGW found that adding two new 500 kilovolt (KV) lines across the Mississippi River to connect to Arkansas, and one 230 kV south to connect to Mississippi would adequately enable connection with the MISO market.

MLGW 2020 IRP Transmission Expansions Geographic Map



Source: MLGW 2020[43]

Key components of both PacifiCorp and MLGW's IRP with transmission planning, as well as MISO's LRTP efforts, is an evaluation of the benefit metrics associated with transmission. For example, TVA should evaluate regional and interregional transmission upgrades that would enable it to fully optimize its fleet operations. One area where this regional and interregional transfer capacity arises includes the IRP modeling limitations on imports and exports. SREA recommends that TVA run at least one sensitivity where such a limitation is removed to identify opportunities for expansion and optimization.

Transmission, like some generation resources, offers several value streams that need to be adequately measured and combined to get a full cost-benefit analysis. Some transmission benefits include increased reliability and operational flexibility, reduced congestion and dispatch costs, reduced reserve margin requirements, improved renewable integration, diversification of generation and load, and adjusted production costs. TVA may need to incorporate locational marginal pricing analyses to fully capture the benefits of its transmission system plans. SREA recommends that TVA work to develop a full list of transmission benefits to conduct cost benefit analysis for transmission upgrades.[44]

---

[42] Memphis Light Gas & Water (July 2020). Integrated Resource Plan Report, Siemens. [http://www.mlgw.com/images/content/files/pdf/MLGW-IRP-Final-Report_Siemens-PTI_R108-20.pdf]

[43] Memphis Light Gas & Water (July 2020). Integrated Resource Plan Report, Siemens. Exhibit 83. [http://www.mlgw.com/images/content/files/pdf/MLGW-IRP-Final-Report_Siemens-PTI_R108-20.pdf]

[44] Johannes Pfeifenberger et al (October 18, 2022). Transmission Planning for a Changing Generation Mix. [https://www.brattle.com/wp-content/uploads/2022/10/Transmission-Planning-for-a-Changing-Generation-Mix.pdf]

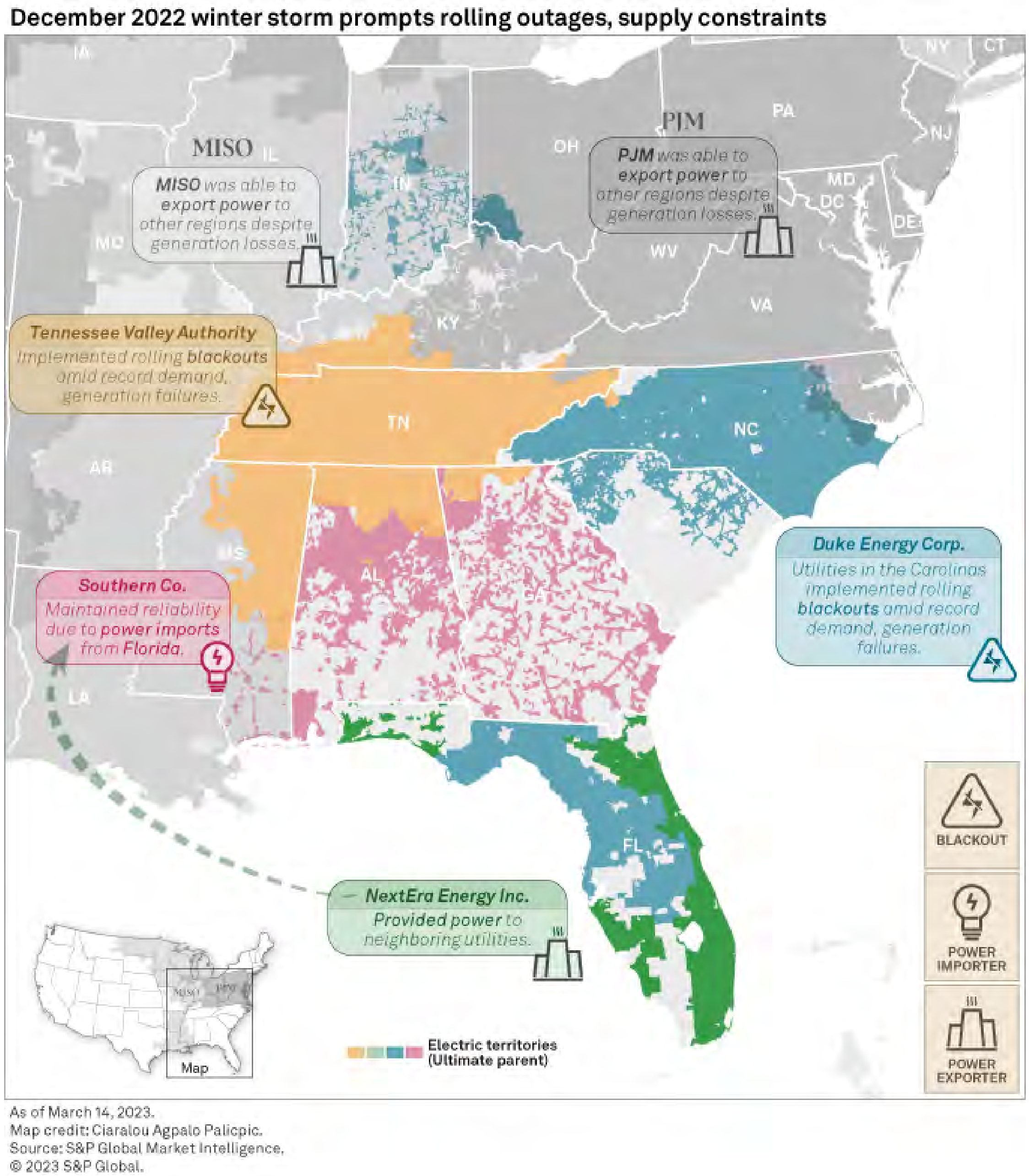
MISO's LRTP efforts include scenario-based planning whereby various generation resources are retired and added, while load is adjusted based on scenario descriptions. MISO provides generator retirement, generation addition, and load forecast data publicly.[45] As such, TVA could incorporate MISO's futures scenarios to ensure that TVA's modeling of that market is provided by that market, enhancing data fidelity between the regions. SREA recommends working with MISO, and neighboring regions, to gain access to the data necessary to accurately model surrounding regions.

IV. Extreme Weather Events

During Winter Storm Elliott, across the TVA region, Duke Energy in the Carolinas, LGEKU, PJM, MISO and SPP, natural gas generators failed to perform as expected. According to analysis by Bloomberg New Energy Finance "On Dec. 23, US natural gas production suffered its worst one-day decline in more than a decade, with roughly 10% of supplies wiped out because of wells freeze-offs. Output was as low as 84.2 billion cubic feet on Saturday, a 16% decline from typical levels, before a slow recovery started, according to BloombergNEF data based on pipeline schedules."[46] Tens of thousands of megawatts of natural gas facilities were derated or otherwise unavailable across the Eastern Interconnect.

[45] Midcontinent Independent System Operator. Future Planning Scenarios. [https://www.misoenergy.org/planning/transmission-planning/futures-development/]

[46] "Deadly Winter Storm Exposes Deep Flaws of US Energy System', Gerson Freitas Jr, Naureen S Malik and Mark Chediak, Bloomberg, December 27, 2022 (https://www.bloomberg.com/news/articles/2022-12-27/deadly-winter-storm-exposes-deep-flaws-of-us-energy-system?leadSource=uverify%20wall)

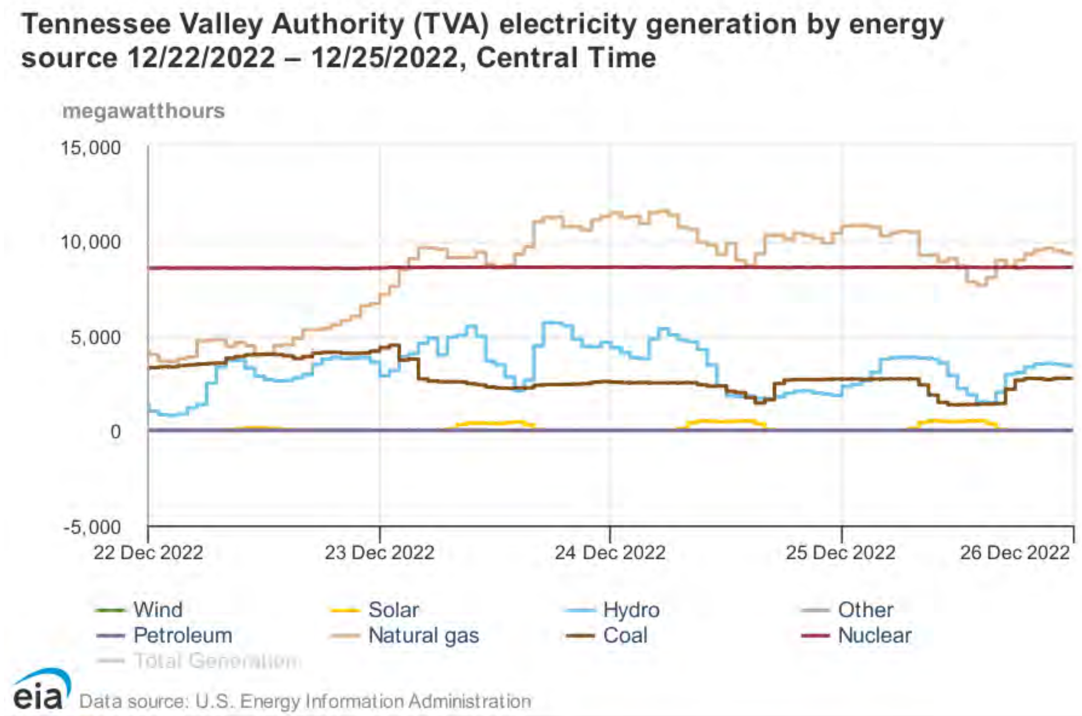


Source: S&P 2023[47]

According to local press after Winter Storm Elliott, on December 23, 2022, "TVA lost more than 6,000 megawatts of power generation or nearly 20% of its load at the time, with both units at TVA's Cumberland Fossil Plant offline and other problems at some gas generating units".[48] TVA

[47] Ciaralou Agpalo Palicpic (March 14, 2023). "Holiday 2022 winter storm raises reliability, generation diversity questions," S&P Global Market Intelligence. [https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/holiday-2022-winter-storm-raises-reliability-generation-diversity-questions-74685081]
[48] Dave Flessner (December 24, 2022). "Chattanooga area hit with 15-minute power outages as cold weather forces rolling blackouts," Chattanooga Times Free Press. [https://www.timesfreepress.com/news/2022/dec/24/power-outages-tfp/]

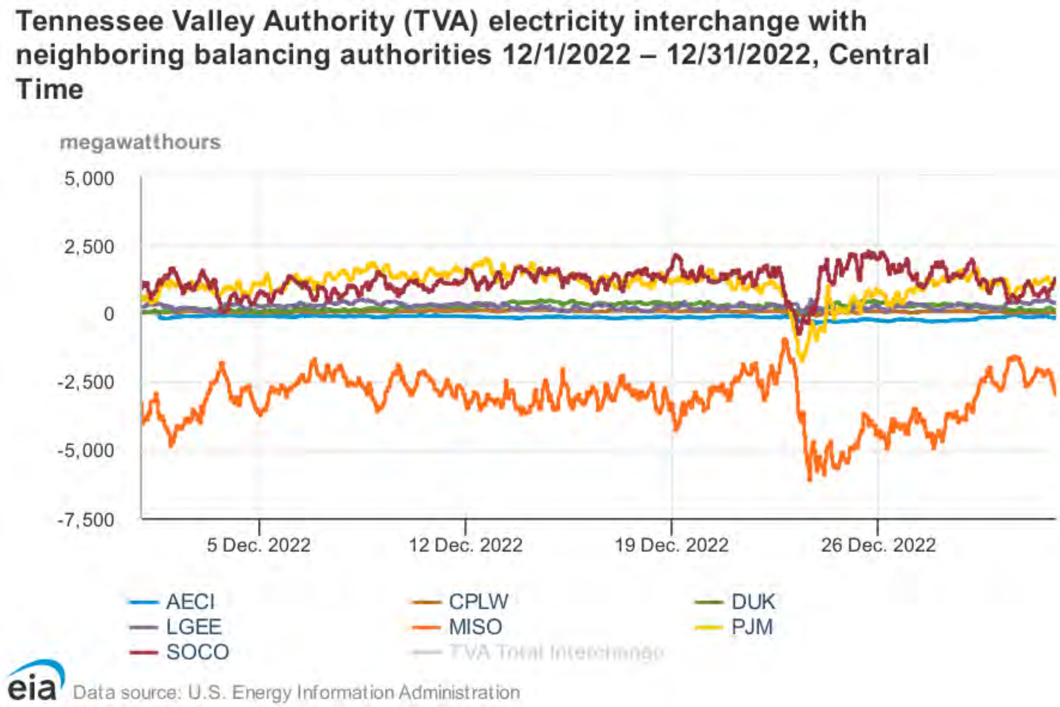
experienced rolling blackouts on December 23rd, as well as December 24th, and had to cut power to at least 10% of their customers to maintain their system.[49] Almost all of TVA's natural gas generators were affected by the storm. In addition to the frozen generators and inadequate fuel supply, utilities in the Southeast underestimated the power demand needs for their individual areas.



Source: EIA Grid Monitor[50]

TVA entered an Energy Emergency Alert Level 3 (EEA3), the highest level and the level at which load shedding occurs, at two separate times during Winter Storm Elliott including Friday, Dec. 23 from 9:31 a.m. to 11:43 a.m. Saturday, Dec. 24 from 4:51 a.m. to 10:31 a.m.[51] TVA relied heavily on imports from neighboring MISO and PJM to prevent even deeper and longer blackouts. For instance, at times during Winter Storm Elliott, TVA was importing over 6,000 MW of power from MISO, 1,700 MW from PJM, and roughly over 300 MW from neighboring AECI. From December 23, 2022 through December 25, 2022, TVA mostly exported power to Southern Company and LGEKU. If TVA had been a part of a larger balancing area like MISO, the Company may have been able to entirely avoid its blackouts.

[49] TVA Press Release, "TVA Accepts Responsibility, Starts Full Review', (December 2022) (https://www.tva.com/newsroom/press-releases/tva-accepts-responsibility-starts-full-review)
[50] Energy Information Administration Grid Monitor. Data were compiled for the utility for the 2022 year. Some data were incomplete as reported by the utility.
[https://www.eia.gov/electricity/gridmonitor/dashboard/electric_overview/US48/US48]
[51] Madalyn Torres (January 19, 2023). "Here's why TVA said there were rolling blackouts before Christmas," 10News. [https://www.wbir.com/article/news/local/tva-artic-blast-rolling-blackouts-east-tennessee/51-9fac437b-6cce-40eb-a0ce-650be785b1de]



Source: EIA Grid Monitor[52]

SREA recommends that TVA incorporate lessons learned from Winter Storm Elliott in this IRP. TVA previously published the results of a Blue Ribbon Committee regarding the storm; however, the information provided in the report is minimal. One way to incorporate Winter Storm Elliott is to include a scenario where the same (or similar) generators are assigned similar capacity values based on actual performance. Another option is to remove import/export limitations to neighboring regions under a stressed sensitivity.

In additions to lessons learned from Winter Storm Elliott, SREA recommends that TVA conduct a study where TVA either works with other utilities across the southeast to create a new regional transmission organization (RTO), or join an existing market, such as MISO or PJM. This type of analysis was recently completed by the Brattle Group for South Carolina decisionmakers. That analysis found that if South Carolina were to join an RTO, the state could save between $140 million to $360 million annually.[53] TVA is currently a member of the Southeastern Energy Exchange Market (SEEM) where bilateral trades are allowed to take place on a 15-minute basis. However, SEEM lacks many of the same functions available in an RTO. Previous studies found that the southeast could

[52] Energy Information Administration Grid Monitor. Data were compiled for the utility for the 2022 year. Some data were incomplete as reported by the utility.
[https://www.eia.gov/electricity/gridmonitor/dashboard/electric_overview/US48/US48]

[53] John Tsoukalis et al (April 27, 2023). Assessment of Potential Market Reforms for South Carolina's Electricity Sector FINAL REPORT TO THE ELECTRICITY MARKET REFORM MEASURES STUDY COMMITTEE OF THE SOUTH CAROLINA GENERAL ASSEMBLY
[https://www.scstatehouse.gov/CommitteeInfo/ElectricityMarketReformMeasuresStudyCommittee/2022-04-27%20-%20SC%20Electricity%20Market%20Reform_Brattle%20Report.pdf]

incorporate more renewable energy resources while reducing overall system costs by adopting broader market reforms.[54]

Recommendations

- Use the latest National Renewable Energy Lab Annual Technology Baseline (NREL ATB) data, to be released on July 24, 2023
- Include the following generation technologies for analysis
  - Solar PV
  - Solar plus batteries
  - Batteries (including 2-, 4-, 8-, and 100-hour batteries)
  - Local wind
  - Imported wind
  - HVDC wind
  - Hydrogen
- Model hydrogen electrolysis load growth in sensitivities and scenarios
- Incorporate the Inflation Reduction Act incentives through 2033, including the Production Tax Credit (PTC) and the Investment Tax Credit (ITC) for all other zero emission technology
- Update resource accreditation methodologies to reflect operational experience for all generation resources
- Fully integrate transmission expansion planning with generation planning
- Conduct analyses that include the effects of extreme weather events
- Conduct a study that evaluates either creating or joining a Regional Transmission Organization, like MISO or PJM

Submitted by

Simon Mahan
Executive Director
Southern Renewable Energy Association
simon@southernwind.org

[54] Energy Innovation (August 25, 2020). Economic And Clean Energy Benefits Of Establishing A Southeast U.S. Competitive Wholesale Electricity Market [https://energyinnovation.org/publication/economic-and-clean-energy-benefits-of-establishing-a-southeast-u-s-competitive-wholesale-electricity-market/]

LPC-owned microgrid sites and customer-owned renewable energy and energy storage systems. TVA can lead the way with proactive transmission planning.

TVA's support, whether through structured incentives for end users or LPCs, and especially with technical guidance for adoption of these type systems, would go a long way toward realizing the advantages of distributed energy.

In closing, I want to provide an image of what we feel is possible here and now. In the next few months, one of our commercial clients will have a solar PV system that provides most of their power needs, in conjunction with a containerized energy storage system that can island the facility during an outage, reduce utility demand, and in turn reduce operating cost. In striving to meet their corporate sustainability goal, they will also be demonstrating the possibilities of current technology.

A forward-looking plan for TVA and the communities it serves can achieve all of these things by wisely enlisting ways to use distributed power.

Jon Hamilton – General Manager
Solar Alliance Southeast

From: Wufoo
To: Integrated Resource Plan
Subject: 2024 Integrated Resource Plan [#24]
Date: Monday, July 3, 2023 10:35:52 AM

Name	Olivia Price
City	Charlotte
State	NC
Organization	Ecoplexus
Email	
Phone Number	
Please provide your comments by uploading a file or by entering them below. *	Will you be providing dates for the remaining stakeholder meetings and will developers have the ability to join and listen in?

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#25]
Date:	Monday, July 3, 2023 12:54:27 PM

Name	Howard Crystal
City	Washington
State	DC
Organization	Center for Biological Diversity
Email	
Phone Number	
Please provide your comments by uploading a file or by entering them below. *	Please see attached comments.
Upload File #1	center_for_biological_diversity_scoping_comments_on_tva_irp_july_3_2023.pdf 2.39 MB · PDF

July 3, 2023

Via email
Kelly Baxter
NEPA Specialist
Tennessee Valley Authority
400 West Summit Hill Drive, WT 11B
Knoxville TN 37902-149
IRP@tva.gov and tva.gov/IRP

Re: TVA Scoping for 2024 Integrated Resource Plan and Environmental Impact Statement

Dear Ms. Baxter:

On behalf of the Center for Biological Diversity ("Center"), we submit these scoping comments on the Tennessee Valley Authority's ("TVA") 2024 Integrated Resource Plan ("IRP") and Environmental Impact Statement ("EIS"). The Center is a national, non-profit conservation organization with more than 1.7 million members and online activists, including approximately 9,000 living in states served by TVA, who care about the country's urgent need to expedite the renewable energy transition and protect human health, the natural environment, and species from the ravages of the climate emergency, extinction crisis, and environmental degradation.

At the outset, we reiterate the concerns raised in the June 12, 2023 letter from the Southern Environmental Law Center, in which six separate conservation groups noted that TVA has stacked numerous public comment periods on top of each other, undermining the public's ability to meaningfully engage in TVA's decision-making, and fundamentally undermining the purpose of NEPA to allow agencies to incorporate public comment into their decisions.

Putting that issue aside, in the TVA's 2024 IRP and EIS TVA must finally confront the most pressing issue facing the public utility's future energy mix: ***addressing the climate emergency.*** To date, TVA has not only ignored the pressing demands of the climate emergency. The nation's largest public power provider has failed to even bring its operations and plans into alignment with the Administration's modest decarbonization goals.

This must change. In announcing the scoping for the new IRP, TVA explained that, through this process, "TVA will identify the most effective energy resource strategy that will meet TVA's mission and serve the people of the region between now and 2050." 88 Fed. Reg. at 32,267. As we explain below, to comply with TVA's statutory mandate to serve its customers, it is essential that TVA change course from the continued reliance on, and build-out of, dirty fossil fuels to rapid decarbonization through renewable and distributed energy resources.

To meet these goals, TVA must rely on the IRP and EIS as an opportunity to shift its focus toward rapid decarbonization, with a particular emphasis on Distributed Energy Resources ("DER") and other energy solutions that will foster local energy control and resilience. In particular, as discussed further below, the IRP and EIS *should focus on the clean energy pathways detailed in the recent Study entitled: TVA's Clean Energy Future: Charting a course to decarbonization in the Tennessee Valley*. ("*TVA Clean Energy Future Report*").[1]

Accordingly, the IRP and associated EIS must address alternatives that will provide accelerated deployment of energy efficiency, DERs, and other non-wires solutions to meet TVA customer's energy needs. Moreover, the IRP and EIS must fully and fairly consider the environmental impacts of TVA's continued reliance on, and build-out of, dirty fossil fuel resources, as compared to affordable, more resilient, and environmentally superior clear energy alternatives.

We look forward to reviewing TVA's Draft EIS addressing these issues.

I. TVA's Statutory Mandates Demand That TVA Rapidly Decarbonize To Help The Communities The Agency Serves Avoid The Worse Impacts of the Climate Emergency.

More than four years ago, TVA prepared its last IRP. Despite calls from the Center and many other advocates for TVA to embrace rapid decarbonization to address the climate emergency, TVA finalized a largely *status quo* IRP in which TVA planned to both continue to rely on dirty fossil fuels and would build additional dirty gas plants in the future.

Much has changed since TVA's last IRP, but one thing remains clear: ***TVA is fundamentally failing the millions of people it serves by keeping its head in the sand concerning its contributions to the climate emergency, and ignoring the massive agency's enormous potential to help lead the clean energy transition, rather than continuing to stand in its way.***

Indeed, given the ever-increasing threats posed by the climate emergency, and TVA's statutory mandates, it is evident that TVA is not only missing huge opportunities, the agency is also violating its governing statutory charter. TVA should use this IRP process to finally change course.

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[1] The full Study is attached (*See* Attachment 1) and is available at the following URL: https://www.biologicaldiversity.org/programs/energy-justice/pdfs/TVAs-Clean-Energy-Future.pdf. The accompanying Policy Brief is available here: https://www.biologicaldiversity.org/programs/energy-justice/pdfs/TVA-Clean-Energy-Roadmap_Policy-Brief.pdf.

A. The Climate Emergency Is Having Devastating Impacts On the People TVA Is Charged To Serve, And Especially The Most Marginalized Communities

1. The Climate Emergency

An overwhelming international scientific consensus has established that human-caused climate change is already causing severe and widespread harms, and that climate change threats are becoming increasingly dangerous. The climate emergency, caused primarily by fossil fuels, poses an existential threat to every aspect of society. Fossil fuel-driven climate change has already led to more frequent and intense heat waves, floods, and droughts; more destructive hurricanes and wildfires; rising seas and coastal erosion; increased spread of disease; food and water insecurity; acidifying oceans; and increasing species extinction risk and the collapse of ecosystems. The climate emergency is killing people across the nation and around the world, and costing the U.S. economy billions in damages every year. The vast scientific literature documenting these findings has been set forth in a series of authoritative reports from the Intergovernmental Panel on Climate Change (IPCC), U.S. Global Change Research Program, and other institutions,[2] which make clear that fossil-fuel driven climate change is a "code red for humanity."[3] Without limits on fossil fuel production and deep and rapid emissions reductions, global temperature rise will exceed 1.5°C and will result in catastrophic damage in the U.S. and around the world.[4]

The harms from the climate emergency and fossil fuel pollution fall first and worst on Black, Brown, Indigenous, and other communities of color, as well as low-wealth and other frontline communities, worsening the crisis for environmental justice communities.[5] The climate

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[2] E.g. U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/; U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Vol. II (2018), https://nca2018.globalchange.gov/; Intergovernmental Panel on Climate Change, Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (2021), https://www.ipcc.ch/report/sixth-assessment-report-working-group-i.

[3] United Nations Secretary-General, *Secretary-General's statement on the IPCC Working Group 1 Report on the Physical Science Basis of the Sixth Assessment*, Aug. 9, 2021, https://www.un.org/sg/en/content/secretary-generals-statement-the-ipcc-working-group-1-report-the-physical-science-basis-of-the-sixth-assessment.

[4] Intergovernmental Panel on Climate Change, Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty (2018) [Masson-Delmotte, V. et al. (eds.)], https://www.ipcc.ch/sr15/

[5] E.g. Donaghy, Tim & Charlie Jiang for Greenpeace, Gulf Coast Center for Law & Policy, Red, Black & Green Movement, and Movement for Black Lives, Fossil Fuel Racism: How Phasing Out Oil, Gas, and Coal Can Protect Communities (2021), https://www.greenpeace.org/usa/wp-content/uploads/2021/04/Fossil-Fuel-Racism.pdf;

emergency also poses additional risks to other vulnerable communities, including children, older adults, immigrant groups, and persons with disabilities and pre-existing medical conditions.[6]

Earlier this year, the Intergovernmental Panel on Climate Change ("IPCC") issued its latest Climate Change Synthesis ("Report") on the state of the climate emergency.[7] Key findings of the Report include:

- *First*, "[h]uman activities, principally through emissions of greenhouse gases, have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850-1900 in 2011-2020. Global greenhouse gas emissions have continued to increase, with unequal historical and ongoing contributions arising from unsustainable energy use, land use and land-use change, lifestyles and patterns of consumption and production across regions, between and within countries, and among individuals."[8]

- Second, "[w]idespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred. Human-caused climate change is already affecting many weather and climate extremes in every region across the globe. This has led to widespread adverse impacts and related losses and damages to nature and people (high confidence). Vulnerable communities who have historically contributed the least to current climate change are disproportionately affected."[9]

U.S. Environmental Protection Agency, Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts, EPA 430-R-21-003 (2021), www.epa.gov/cira/social-vulnerability-report. Carina J. Gronlund, *Racial and socioeconomic disparities in heat-related health effects and their mechanisms: a review,* Curr. Epidemiol. Rep. 1 (3): 165-173 (2014) at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4264980/; R. Dean Hardy, Richard A. Milligan, and Nik Heynen, *Injustice of colorlind adaptation planning for sea-level rise,* Geoforum, 87: 62-72 (2017) at (https://www.sciencedirect.com/science/article/pii/S0016718517302944; NAACP, *Environmental and Climate Justice,* at https://www.naacp.org/issues/environmental-justice/. We use the term "environmental justice communities"' in accordance with the definition provided by the White House Environmental Justice Advisory Council ("WHEJAC"), which defines the term as "a geographic location with significant representation of persons of color, low-income persons, indigenous persons, or members of Tribal nations, where such persons experience, or are at risk of experiencing, higher or more adverse human health or environmental outcomes." White House Env'tal Justice Advisory Council, 79 (May 21, 2021), *WHEJAC Final Report Executive Order 14008*, https://www.epa.gov./sites/production/files/2021-05/documents/whiteh2.pdf.

6 NCA4, Vol. II, at 540, 548; U.S. Global Change Research Program, The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment (2016); *see also* Nick Watts, *et al.*, *Health and climate change: policy responses to protect public health,* 386 The Lancet 1861 (2015) at 1861.

7 *See* IPCC, *Climate Change 2023, Synthesis Report: Summary for Policymakers* (2023), https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf.

8 *Id.* at 4.

9 *Id.* at 5.

- Third, "[c]ontinued greenhouse gas emissions will lead to increasing global warming, with the best estimate of reaching 1.5°C in the near term in considered scenarios and modelled pathways. Every increment of global warming will intensify multiple and concurrent hazards. **Deep, rapid, and sustained reductions in greenhouse gas emissions would lead to a discernible slowdown in global warming within around two decades**, and also to discernible changes in atmospheric composition within a few years."[10]

- Finally, "[l]imiting human-caused global warming **requires net zero CO2 emissions**. Cumulative carbon emissions until the time of reaching net zero CO2 emissions and **the level of greenhouse gas emission reductions this decade largely determine whether warming can be limited to 1.5°C or 2°C** (high confidence). **Projected CO2 emissions from existing fossil fuel infrastructure without additional abatement would exceed the remaining carbon budget for 1.5°C.**"[11]

In light of these stark conclusions, the United Nations Secretary General Antonio Guterres has made clear that "**Fossil fuels are a dead end — for our planet, for humanity, and […] for economies. A prompt, well-managed transition to renewables is the only pathway to energy security, universal access and the green jobs our world needs**."[12]

The U.S. federal government has also repeatedly recognized that human-caused climate change is causing widespread and intensifying harms across the country in the authoritative National Climate Assessments ("NCA"), scientific syntheses prepared by hundreds of scientific experts and reviewed by the National Academy of Sciences and federal agencies. In the recently issued Draft of the Fifth NCA ("NCA5"), the authors explain that although "the effects of human-caused climate change on the United States are already far-reaching and worsening, **every additional amount of warming that we avoid or delay will reduce harmful impacts**."[13] The Draft NCA5 also once again reaffirms that "[t]he effects of climate change are felt most strongly

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10 *Id.* at 12 (emphasis added).

11 *Id.* at 19 (emphasis added).

12 *See* Secretary-General's video message to the Press Conference Launch of IPCC Report, (February 28, 2022), https://www.un.org/sg/en/content/sg/statement/2022-02-28/secretary-generals-video-message-the-press-conference-launch-of-ipcc-report-scroll-down-for-languages (emphasis added).

13 Draft 5th NCA at 1-4 (emphasis added); *see also* Fourth National Climate Assessment (2018), https://nca2018.globalchange.gov/. The National Academy of Sciences (NAS) recently issued their own review praising the scientific bases for the Draft Fifth NCA. *See* NAS, Review of the Draft Fifth National Climate Assessment (2023), https://www.nationalacademies.org/news/2023/03/new-report-review-of-the-draft-fifth-national-climate-assessment.

by communities that are already overburdened, including Indigenous peoples, people of color, and low-income communities."[14]

The electricity sector is a leading source of U.S. greenhouse gas (GHG) emissions, making up 25% of total GHG emissions in 2021.[15] Utilities therefore have a unique responsibility to decarbonize their operations and shift away from the fossil fuel energy harming marginalized and vulnerable communities, as well as species. To that end, President Biden's Executive Order directs the federal government to transform the entire U.S. electricity sector to be carbon-free by *2035*.[16]

Many studies have also demonstrated the number of lives that can be saved through rapid GHG emission reductions.[17] Conversely, failing to reduce GHG emissions will not only cause these more direct public health harms, but will also cause devastating economic losses that will even further aggravate these threats.

Global average atmospheric carbon dioxide in 2020 was 412.5 parts per million (ppm), a level not seen for millions of years.[18] The last time CO_2 in the Earth's atmosphere was at 400 ppm, global mean surface temperatures were 2 to 3°C warmer and the Greenland and West Antarctic ice sheets melted, leading to sea levels that were 10 to 20 meters higher than today.[19] The current atmospheric CO_2 concentration is nearly one and a half times larger than the pre-industrial level

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14 *Id.* at 1-13 ("These frontline communities experience harmful climate impacts first and worst, yet are often the least responsible for the greenhouse gas emissions that cause climate change. Climate change exacerbates existing risks to these communities from unmet infrastructure needs, low-quality housing, and other stressors, creating a cycle of worsening inequality").

15 U.S. Env't Prot. Agency, *Sources of Greenhouse Gas Emissions*, EPA, https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions (2021).

16 Exec. Ord. on Tackling the Climate Crisis at Home and Abroad, No. 14,008, 86 Fed. Reg. 7619, §§ 201 and 205(b)(i) (Jan. 27, 2021) ("Biden Order") (Jan. 27, 2021), https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/.

17 E.g. Antonio Gasparrini, *et al.*, *Projections of temperature-related excess mortality under climate change scenarios*, 1 Lancet Planet Health e360 (2017); Solomon Hsiang, *et al., Estimating economic damage from climate change in the United States*, 356 Science 1362 (2017); Raquel A. Silva, *et al.*, *Future global mortality from changes in air pollution attributable to climate change*, 7 Nature Climate Change 647 (2017); Marshall Burke, *et al., Higher temperatures increase suicide rates in the United States and Mexico*, 8 Nature Climate Change 723 (2018); Drew Shindell, *et al., Quantified, localized health benefits of accelerate carbon dioxide emissions reductions*, 8 Nature Climate Change 723 (2018).

18 *See* Rebecca Lindsey, *Climate Change: Atmospheric Carbon Dioxide, Climate.gov,* https://www.climate.gov/news-features/understanding-climate/climate-change-atmospheric-carbon-dioxide.

19 Corinne Le Quéré, *Global carbon budget 2018*, 10 Earth Syst. Sci. Data 2141 (2018); World Meteorological Organization, *WMO Greenhouse Gas Bulletin*, No. 13, October 30, 2017 at 5.

of 280 ppm, and much greater than levels during the past 800,000 years.[20] The atmospheric concentrations of methane (CH_4) and nitrous oxide (N_2O), two other potent GHGs, are more than 257 % and 122 % of their pre-industrial levels.[21]

In light of the climate emergency, the IPCC has emphasized the urgent need for "rapid and far-reaching transitions" across all sectors including electricity generation.[22] A critical feature of 1.5°C-consistent pathways is that the power sector must be significantly clean by 2030 and achieve a "virtually full decarbonisation" around mid-century.[23] For electricity in particular, the share of renewable energy must reach 60% by 2030 and 77% by 2050.[24] Yet at current emission rates, with continued fossil fuel development, we are set to overshoot 1.5°C of warming in less than a decade.[25] More recent studies underscore that in order to preserve a livable planet and for a decent chance at limiting global warming to 1.5 degrees Celsius, the United States should phase-out coal use and significantly reduce fossil gas generation by 2030.[26]

2. The Climate Emergency in TVA's Territory

The last final NCA, NCA4, included a Volume II, *Impacts, Risks, and Adaptation in the United States*, that specifically addresses climate change impacts on the Tennessee Valley as a result of increased hurricanes, extended wildfire seasons, and myriad other impacts.[27] The Assessment also details how lower-income and marginalized communities will experience even greater impacts to their health, safety and quality of life than others.[28]

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[20] IPCC, *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the IPCC* (2014) at 4, 44; World Meteorological Organization, WMO Greenhouse Gas Bulletin, No. 13, October 30, 2017 at 1, 4.

[21] *Id.* at 2.

[22] *Id.* at 15.

[23] IPCC Special Report, at 112.

[24] IPCC Special Report, Summary for Policymakers, at 12.

[25] Intergovernmental Panel on Climate Change, *Synthesis Report of the IPCC Sixth Assessment Report (AR6)* (2023), https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_LongerReport.pdf.

[26] *See* Evolved Energy Research, *Annual Decarbonization Perspective 2022,* (January 13, 2023), https://www.evolved.energy/post/adp2022. *See also* National Renewable Energy Laboratory, 100% Clean Electricity by 2035 Study, https://www.nrel.gov/analysis/100-percent-clean-electricity-by-2035-study.html.

[27] U.S. Global Climate Change Research Program, "Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II: Summary Findings" (November 23, 2018), at 47.

[28] *Id.* at 1.

The southeastern United States, a part of which is TVA's territory, has been facing and will continue to face extraordinary harms from climate change.[29] As the Environmental Protection Agency has detailed, climate change in the Southeast has already led to: (1) higher temperatures and greater demand for water will strain water resources in the Southeast; (2) higher incidences of extreme weather, increased temperatures, and flooding that will likely impact human health, infrastructure, and agriculture; (3) sea level rise that is expected to contribute to increased hurricane activity and storm surge, and will increase the salinity of estuaries, coastal wetlands, tidal rivers, and swamps; and (4) coastal communities' experiencing of warmer temperatures and the impacts of sea level rise, including seawater flooding.[30] In other words, the impacts of climate change on TVA's territory and the communities that the agency serves are concrete, palpable, and are projected to be exacerbated—and will certainly do so should TVA fail to consider and pursue alternatives that rapidly reduce fossil fuel consumption.

Just within the past year, communities in the Tennessee Valley have faced record-breaking tornadoes, floods, heat waves, winter storms, and even hazardous air quality from wildfires. One extreme weather event in particular, Winter Storm Elliot, put TVA's energy grid in peril and caused widespread coal and gas plant failures that resulted in the first rolling blackouts in TVA's history. Even more, TVA's system is increasingly vulnerable to these climate disasters. A U.S. Government Accountability Office (GAO) report found that TVA's system faces several climate-related risks that could cost customers billions of dollars in outages, capacity disruptions, and infrastructure damage.[31]

B. Given These Harms, TVA's Mandate Demands Immediate Decarbonization.

TVA operates the largest public power system in the nation, providing electricity to about 10 million people in an 80,000-square mile area comprised of most of Tennessee and parts of Virginia, North Carolina, Georgia, Alabama, Mississippi, and Kentucky. It provides wholesale electricity to 153 independent power distributors and 58 directly served large industrial and federal customers. 88 Fed. Reg. 32,265, 32,266 (May 19, 2023).

TVA generates most of the power it distributes with 3 nuclear plants, 5 coal-fired plants, 9 simple-cycle combustion turbine plants, 8 combined-cycle combustion turbine plants, 29 hydroelectric dams, a pumped-storage facility, a diesel-fired facility, and 13 solar photovoltaic facilities. *Id.* In 2022, TVA generated 13% of its electricity from coal plants and 22% from dirty gas facilities. *Id.*

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[29] U.S. EPA, "Climate Impacts in the Southeast," available at: https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-southeast_.html.

[30] *Id*.

[31] *Tennessee Valley Authority: Additional Steps Are Needed to Better Manage Climate-Related Risks*, U.S. Government Accountability Office (Jan. 30, 2023), https://www.gao.gov/products/gao-23-105375.

The TVA Act mandates that, in managing its electric generation system, TVA protect "the economic, environmental, social, or physical well-being" of the customers it serves. 16 U.S.C. § 831a(g)(1)(K)(ii). Congress has also mandated that, in planning for new resources, TVA must "evaluate[ ] the *full range* of existing and incremental resources (including new power supplies, energy conservation and efficiency, and renewable energy resources)" that can be relied on to serve "electric customers of the Tennessee Valley Authority at the lowest system cost." *Id.* § 831m-1(b)(1)(emphasis added); *see also id.* § 831a(b)(5) (setting out TVA's mission to be "a national leader in technological innovation, low-cost power, and environmental stewardship").

In light of these mandates, ***and the concrete and immediate threats the climate emergency poses to the customers TVA serves***, it is abundantly clear that TVA must rapidly decarbonize to fulfill its statutory mandates. In short, it entirely ***disserves*** the "economic, environmental, social, [and] physical well being" of TVAs customers for the agency to continue to fuel the climate emergency by not only maintaining a massive fossil fuel energy fleet, but continuing to build new dirty fossil fuel facilities, as TVA is currently planning. Rather, to conform to both Congressional mandates and Presidential directives, TVA must use this IRP planning process to finally reverse course and chart a path to 100% clean, renewable energy by 2035.

II. TVA's IRP Must Meaningfully Address The Catastrophic Impacts Of TVA's Continued Reliance On A Largely Fossil Fuel Resource Generation Mix.

NEPA requires that TVA "consider every significant aspect of the environmental impact of a proposed action." *Baltimore Gas & Elec. Co.*, 462 U.S. at 97. The new IRP EIS must therefore address all the effects of the totality of TVA's operations which would result from the implementation of the proposed IRP.

TVA's 2019 IRP reported that TVA was using ***tens of billions of pounds*** of coal, and more than ***300 billion cubic feet of natural gas*** to generate electricity every year.[32] As a result, TVA annually generates enormous amounts of pollution – including millions of pounds of sulfur dioxide and nitrogen oxide from coal plants; additional millions of pounds of sulfur dioxide; and hundreds of millions of pounds of nitrogen oxide, from gas plants.[33] In addition, the TVA fossil fuel plant fleet emits tens of millions of tons of carbon dioxide that exacerbate the climate crisis; billions of pounds of toxic coal ash that endanger the health of Tennessee Valley communities; and enormous amounts of fossil gas from TVA's massive gas plant operations.[34]

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[32] *See* 2019 IRP EIS at 2-4 to 2-7. The amount of dirty gas has almost certainly increased since the 2019 IRP.

[33] *See* Tennessee Valley Authority, TVA at a Glance, available at https://www.tva.gov/About-TVA/TVA-at-a-Glance.

[34] 2019 IRP EIS at 3-4.

All of these emissions and pollution must be fully addressed in the IRP. This must also include all of the upstream pollution associated with TVA's acquisition and delivery of these polluting energy sources. Courts have consistently required federal agencies to consider climate change emissions—and costs—in connection with the sale of fossil fuels, rejecting agency arguments that the connection between the agency decision at issue and the subsequent emissions is too uncertain and attenuated to require NEPA consideration. *See, e.g., WildEarth Guardians v. BLM*, 870 F. 3d 1222, 1236 (10th Cir. 2017) (requiring consideration of ultimate emissions resulting indirectly from sale of coal).[35] Accordingly, TVA must fully address the pollution coming from its power plants, and all the associated upstream pollution caused as a result of acquiring these resources. *See also Sierra Club v. FERC,* 867 F.3d 1357, 1375 (D.C. Cir. 2017).

Importantly, TVA may not essentially ignore the agency's massive contribution to GHG emissions on the grounds that those emissions are relatively small on a global scale. NEPA requires a robust consideration of the impacts of a project's GHG emissions in terms of its relationship to climate change. Thus, although some "speculation is . . . implicit in NEPA," agencies may not "shirk their responsibilities under NEPA by labeling any and all discussion of future environmental effects as crystal ball inquiry." *N. Plains Res. Council, Inc. v. Surface Transp. Bd.*, 668 F.3d 1067, 1079 (9th Cir. 2011) (citation omitted).

Accordingly, the IRP and associated EIS must include a robust consideration of the role of TVA's GHG emissions in fueling the climate emergency. Moreover, once TVA has added the necessary alternative(s) charting a path to zero emissions, TVA must consider — and inform the public about—the likely environmental outcomes under the different alternatives.

TVA must also incorporate the best scientific evidence concerning critical issues including the social cost of carbon[36]; methane leakage[37]; and species impacts.[38] Only with the most robust consideration of these vital issues can TVA comply with NEPA.

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[35] *See also, e.g., Dine Citizens Against Ruining Our Env't v. Office of Surface Mining Reclamation & Enf't*, 82 F. Supp. 3d 1201 (D. Colo.2015) (same); *WildEarth Guardians v. Office of Surface Mining, Reclamation & Enf't*, 104 F. Supp. 3d 1208, 1230 (D. Colo. 2015) (same); *Conservation Advocates v. U.S. Forest Serv.*, 52 F. Supp. 3d 1174 (D. Colo. 2014)(same); *accord Mid States Coal. for Progress v. Surface Transp. Bd.*, 345 F.3d 520, 549 (8th Cir. 2003) (requiring consideration of air quality and greenhouse gas emissions associated with coal transportation); *N. Plains Res. Council, Inc. v. Surface Transp. Bd.*, 668 F.3d 1067, 1082 (9th Cir. 2011) (same); *Mont. Envtl. Info. Ctr. v. United States Office of Surface Mining*, 274 F. Supp. 3d 1074 (D. Mont. 2017) (same).

[36] *See, e.g., Working Toward a New Social Cost of Carbon*, RFF (Oct. 21, 2021), *https://www.resources.org/archives/working-toward-a-new-social-cost-of-carbon/*.

[37] *See, e.g. , Major Studies Reveal 60% More Methane Emissions*, EDF, *https://www.edf.org/climate/methane-studies;* Karen Rives, *Natural gas use may affect climate as much as coal does if methane leaks persist*, SPGlobal, Dec. 27, 2021, *https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/natural-gas-use-may-affect-climate-as-much-as-coal-does-if-methane-leaks-persist-68096816* .

[38] *See, e.g.,* 2019 IRP Scoping Report at 166-77 (discussing species impacts of TVA operations).

III. TVA's IRP Must Address Decarbonization Alternatives, Including Energy Efficiency, Distributed Energy Resources, Microgrids, Demand Response, And Other Non-Wires Solutions To Meet TVA Customers' Energy Needs

It is also essential that the IRP fully explore the myriad decarbonization alternatives available to TVA in order to mitigate these adverse impacts. This includes multiple combinations of resources, including not just utility-scale renewables and storage, but also energy efficiency, distributed energy resources ("DERs"), microgrids, demand response and other non-wires solutions.

To guide this analysis, TVA should fully incorporate the recently issued Report *TVA's Clean Energy Future: Charting a course to decarbonization in the Tennessee Valley*. ("*TVA Clean Energy Future Report*").[39]

As that Report details:

- a TVA clean energy future can reduce greenhouse gas emissions; meet the region's energy and capacity needs; provide reliable electricity; and generate enormous economic, public health, and energy justice benefits, on the order of ***hundreds of billions of dollars***.[40]

- A 100% Clean Energy scenario produces economy-wide net savings of $255 billion over the study period throughout the Tennessee Valley.[41]

- TVA can transition to 100% clean energy without any resulting reliability issues; the modeled scenarios meet both summer and winter reserve requirements every year.[42]

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39 The full Study is attached (*see* Attachment 1) and is available at the following URL, and is incorporated here by reference: https://www.biologicaldiversity.org/programs/energy-justice/pdfs/TVAs-Clean-Energy-Future.pdf . The accompanying Policy Brief is available here: https://www.biologicaldiversity.org/programs/energy-justice/pdfs/TVA-Clean-Energy-Roadmap_Policy-Brief.pdf.

40 *Id.*

41 *Id.*

42 *Id.*

- By emphasizing flexible demand resources, TVA can minimize the need to construct battery storage and utility-scale solar resources. By better utilizing advanced demand response and distributed resources, TVA ***could avoid the construction of 2 GW of utility scale solar and over 20 GW of battery storage***.[43]

- By increasing levels of distributed resources, ***TVA could save customers $1.5 billion in 2050 alone.***[44]

- A clean energy transition would add more than 15,000 jobs annually to the economy in TVA's service territory, driven by the construction of new solar, storage, and heat pump resources, as well as savings on energy expenditures.[45]

- A clean energy transition would create vast amounts of public health and societal benefits – up to $27 billion in nationwide public health benefits related to avoided heart attacks, respiratory illnesses, and premature death; and $265 billion in cumulative societal benefits, based on the latest estimates of social cost of carbon from the U.S. Environmental Protection Agency (EPA).[46]

- Land-use impacts in the Tennessee Valley can be minimized through an emphasis on distributed resources. To achieve the level of utility-scale solar needed, each county in TVA's service territory would need to build the equivalent of just 480 MW solar facilities, or roughly two large solar farms.[47]

Given these opportunities — and the detail provided in the Report, which is attached — we expect TVA will include the proposals in the Report as an alternative that it will fully and fairly consider in the IRP EIS. ***Particularly given the level of detail the Report includes, it would be an abdication of TVA's NEPA obligations for the agency to dismiss the Report and its proposals and refuse to give them full consideration in the IRP EIS.***

We also note that while TVA is also working on its Valley Pathways Study[48], the agency may not rely on this new Study — ***which is being completed outside of the NEPA process —*** as an excuse to avoid any of the issues discussed here. We would be particularly concerned if TVA

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43 *Id.*

44 *Id.*

45 *Id.*

46 *Id.*

47 *Id.*

48 *See TVA Valley Pathways,* https://www.tva.com/environment/valley-pathways-study.

seeks to rely on the preparation of the Pathways Study — anticipated in 2024 — as a basis to refuse to consider the approach to the TVA region's energy future detailed in the attached *TVA Clean Energy Future Report* when the agency issues the Draft IRP EIS. In short, TVA cannot rely on a non-NEPA process to avoid fully considering information supplied to the agency in the NEPA process that is vital to the agency's decision-making.

Here, the agency is deciding how the Tennessee Valley will meet its energy needs in the coming decades. As detailed in the *TVA Clean Energy Future Report*, and as even TVA has recognized in launching the Valley Pathways Study, this concerns much more than simply the generation mix of TVA-generated centralized power.

Accordingly, we expect the IRP, and associated EIS, will fully and fairly address alternatives for how TVA can best fulfill its mission to serve "the economic, environmental, social, or physical well-being" of its customers, 16 U.S.C. § 831a(g)(1)(K)(ii), through an appropriate combination of TVA supplied power, energy efficiency, distributed energy, and the many other energy delivery and management technologies available.

In sum, we trust TVA will take this opportunity to finally embrace its Congressional charter to be "**a national leader in technological innovation**," 16 U.S.C. § 831a(b)(5) (emphasis added), rather than continuing to be a leading contributor to the climate emergency, and thus an enormous obstacle to addressing the most pressing issue of our time. Indeed, we are attaching the sign-on of more than 6,500 concerned Americans across the country who urge TVA to "immediately chart a path to 100% clean energy by 2035," and to become "the forefront of a nationwide energy transition from volatile, risky, and unreliable fossil fuels to distributed, resilient, lower-cost renewable energy."[49]

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[49] *See* Center Petition, *Lead a 100% Clean Energy Revolution at TVA*, Attachment 2.

Thank you for the opportunity to submit these scoping comments and please contact us if there is any further information we can provide at this time.

Sincerely yours,

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ATTACHMENT 1

TVA's Clean Energy Future

Charting a course to decarbonization in the Tennessee Valley

Prepared for GridLab and Center for Biological Diversity

March 8, 2023

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CONTENTS

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Consumers in TVA's service territory can save $255 billion by switching away from fossil fuels.

EXECUTIVE SUMMARY

Tennessee Valley Authority (TVA), the largest provider of public power in the United States, is uniquely positioned to lead the way in the clean energy transition for Tennessee Valley. The U.S. Congress created TVA, originally conceived as a flood-control solution, as a federally owned electric utility in the 1930s to electrify the Tennessee Valley and bring economic benefits to the region. Today, TVA has the chance to continue this legacy through the 21st century with a shift to clean energy.

Our "100% Clean Energy" scenario shows that by completely switching away from fossil fuels in the electric sector by 2035, and by pursuing ambitious levels of electrification in the transportation, buildings, and industrial sectors, consumers in TVA's service territory can experience savings of $255 billion, compared to a status quo "TVA Baseline" scenario.

This clean energy transition will involve a major shift away from TVA's conventional emphasis on aging fossil technology towards new technology, including storage, solar, wind, and demand-side resources. Changes in the electric sector will accompany a shift away from burning dirty and inefficient fossil fuels in homes, businesses, and vehicles. This future electric sector leverages efficient electric-powered technology to meet expanded heating and mobility needs for the same customers that TVA is already serving. By taking advantage of new federal legislation, particularly the *Inflation Reduction Act of 2022*, TVA is poised to lead a transition that can produce benefits for local consumers such as improved air and water quality, as well as job creation.

Synapse was hired by GridLab, in partnership with Center for Biological Diversity, to better understand what it would take to achieve this clean energy transition. Using state-of-the-art electric sector and economic computer models, we examined TVA's electric system at a detailed level from the early 2020s through 2050. By conducting scenario analysis of several different visions of the future, we compared a scenario that accelerates a clean energy future using storage to balance solar and wind without fossil fuels to a scenario that adheres to TVA's status quo approach. We found that a clean energy future that reduces greenhouse gas emissions not only meets energy and capacity needs and provides electricity reliably, but also generates a wealth of economic development, public health, and energy justice benefits to Tennessee Valley consumers (on the order of hundreds of billions of dollars).

Table 1 illustrates the magnitude of this change in the electric sector. We modeled a shift from a current TVA that is dependent on fossil fuels for 40 percent of electricity generation (the "TVA Baseline" scenario) to a TVA that phases out fossil fuels entirely by 2035 (the "100% Clean Energy" scenario). By 2050, this future reduces emissions from all sectors of the Tennessee Valley's economy by over 90 percent.[1] Table 2 shows the estimated economic impacts. When compared to a status quo TVA approach, this clean energy future produces savings of $255 billion for consumers. Moreover, electricity is served reliably despite the system having more than double the current demand for electricity and exclusive reliance on non-emitting energy resources such as wind, solar, and battery storage.

Table 1. Primary electric-sector findings

	2020	2035		2050	
	Actual	*TVA Baseline*	*100% Clean Energy*	*TVA Baseline*	*100% Clean Energy*
CO_2 emissions reduction					
Electric sector reductions (target)	51%	84% (n/a)	100% (100%)	99% (n/a)	100% (100%)
All sector	-	26%	55%	41%	92%
Share of generation (%)					
Coal	12%	0%	0%	0%	0%
Gas	31%	24%	0%	2%	0%
Nuclear	38%	39%	30%	35%	17%
Hydro and other	16%	17%	22%	18%	19%
Renewable	3%	20%	48%	46%	64%
Wind	3%	4%	19%	22%	32%
Utility-scale & distributed solar	0%	16%	28%	23%	32%
Battery storage & demand response	-	-	-	-	-
Load (TWh)	164	169	192	179	327
Operating capacity (GW)					
Coal	7	0	0	0	0
Gas	15	13	1	6	0
Nuclear	8	8	8	8	8
Hydro and other	7	7	6	6	6
Renewable	2	22	72	60	191
Wind	1	2	14	13	41
Utility-scale & distributed solar	0	15	35	37	101
Battery storage & demand response	1	5	23	11	49

Notes: Electric sector emission reductions are given relative to 2005. All Sector emission reductions are given relative to 2020. Battery storage is shown as having no generation due to having net negative energy requirements. "Other" includes biomass and other miscellaneous sources.

[1] Throughout this report, "all sector emissions" include CO_2 emissions from the electric, motor vehicle, and building sectors, but not non-CO_2 GHG emissions, upstream emissions, or emissions from airplanes, agriculture, and other sectors of the economy.

Table 2. Single-year and cumulative net costs, 100% Clean Energy versus TVA Baseline (2021 $ billion)

	2035	2050	Cumulative
Electric system	-$1.2	-$4.6	-$53.9
Buildings	$0.0	$0.6	$9.2
Transportation	$8.1	$22.0	$277.2
Other	$0.1	$3.9	$23.0
Net savings	**$7.1**	**$21.8**	**$255.6**

Note: Positive numbers are savings while negative numbers are costs. "Electric system" includes wholesale energy costs, and programmatic and participant spending on energy efficiency and distributed generation resources. "Buildings" includes the costs and savings related to switching residential and commercial customers to efficient heat pumps and electrifying all remaining end uses, inclusive of avoided fossil fuel expenditures. "Transportation" includes the costs and savings related to consumers switching from conventional internal combustion engine vehicles to electric vehicles, including avoided fossil fuel expenditures, as well as the cost of building out charging infrastructure for EVs. "Other" includes fuel savings related to electrifying the industrial sector but does not include the costs of electrification itself. This list is non-exhaustive; see subsection "System costs" on page 23 for more.

Our analysis also found:

- **The 100% Clean Energy scenario produces economy-wide net savings of $255 billion over the study period throughout the Tennessee Valley.** Although wholesale electric sector system costs rise from about $5 billion today to $9 billion in 2050, these cost increases are more than offset by fuel savings outside the electric sector, including a reduction in transportation fossil fuel expenditures of $195 billion over 30 years. Electric sector cost increases are primarily driven by capacity additions needed to power newly electrified measures, and is not due to switching from fossil fuels to clean energy.

- **Through continued emphasis on energy efficiency, residential energy burdens fall from 7 percent today to 3 percent by 2050.** Residential energy burden is defined as the amount of money a household spends on energy, relative to its income. Through an emphasis on more efficient clean energy and away from less efficient and volatile fossil sources, households spend less on their energy needs in a clean energy future. This is in spite of a 13 percent increase in monthly electricity bills, which is more than offset by a marked decrease in household fossil fuel spending on gasoline and home heating fuels.

- **Both primary scenarios achieve (and sometimes exceed) their clean energy targets with no reliability issues.** With the level of temporal resolution we modeled (8 three-hour blocks per day in a typical week) we did not see any hours with unserved energy. In addition, the modeled scenarios met both summer and winter reserve requirements every year. We note that a full evaluation of reliability in an all-clean electric grid would require more detailed stochastic analysis.

- **The TVA Baseline scenario shows that electric-sector emissions in 2050 can be reduced by 99 percent with no increases in costs.** We observed electric system costs of about $5 billion in every year of the TVA Baseline case. This suggests that clean energy deployment is already a least-cost option for TVA, even without enforced decarbonization constraints.

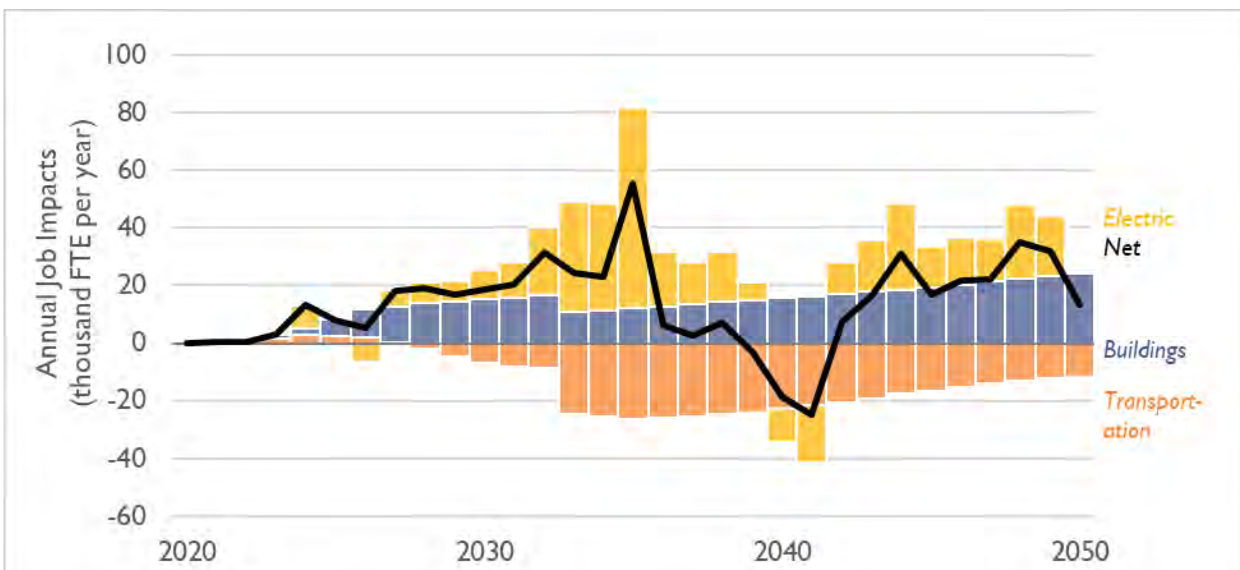
- **Ambitious building decarbonization in the 100% Clean Energy scenario adds no new net electricity demand.** Because many TVA customers currently heat with inefficient electric resistance heating, switching to more efficient heat pumps offsets any additional electricity demand created by switching from natural gas heating to heat-pump-driven electric heating. Instead, most load growth is due to transportation electrification and industrial electrification, each representing about half of the total increase in load by 2050. Moderate and reasonable increases in the deployment of conventional energy efficiency measures throughout the study period helps to defer load growth.

- **An emphasis on flexible demand resources can help minimize the construction of battery storage and utility-scale solar resources.** By better utilizing advanced demand response and distributed resources, TVA could avoid the construction of 2 GW of utility-scale solar and over 20 GW of battery storage. By analyzing increased levels of distributed resources in our "Ambitious DER" scenario, we found that TVA consumers could reduce wholesale electric sector costs by $1.5 billion in 2050 alone.

- **Both scenarios project a shift away from TVA-owned resources.** The TVA Baseline scenario models 45 TWh of wind power purchase agreements (PPA) with neighboring regions by 2050; the 100% Clean Energy scenario has 130 TWh of non-TVA wind PPAs (about one-third of TVA's total generation). This is largely due to the more favorable economics and better capacity factors of midwestern wind, even accounting for (a) TVA's new eligibility for federal clean energy tax credits under the IRA (2022) and (b) cost of transmission lines to neighboring regions to facilitate this wind. This is a marked shift away from TVA's approach to procuring power today, where only a small fraction of energy comes from out-of-Valley renewables.

- **A clean energy transition adds about 15,600 job-years to the economy in TVA's service territory.** Job additions are driven by the construction of new solar, storage, and heat pump resources, as well as savings on energy expenditures (see Figure 1).

Figure 1. Job impacts from the 100% Clean Energy scenario, relative to the TVA Baseline scenario



- **A clean energy transition creates vast amounts of public health and societal benefits.** The 100% Clean Energy scenario leads to $27 billion in nationwide public health benefits related to avoided heart attacks, respiratory illnesses, and premature death. It also provides $265 billion in cumulative societal benefits, based on the latest estimates of social cost of carbon from the U.S. Environmental Protection Agency (EPA). Both of these benefits are in addition to the benefits shown above in Table 2. Switching away from fossil fuels to clean energy sources eliminates the creation of coal ash and more than halves water consumption from power plants.

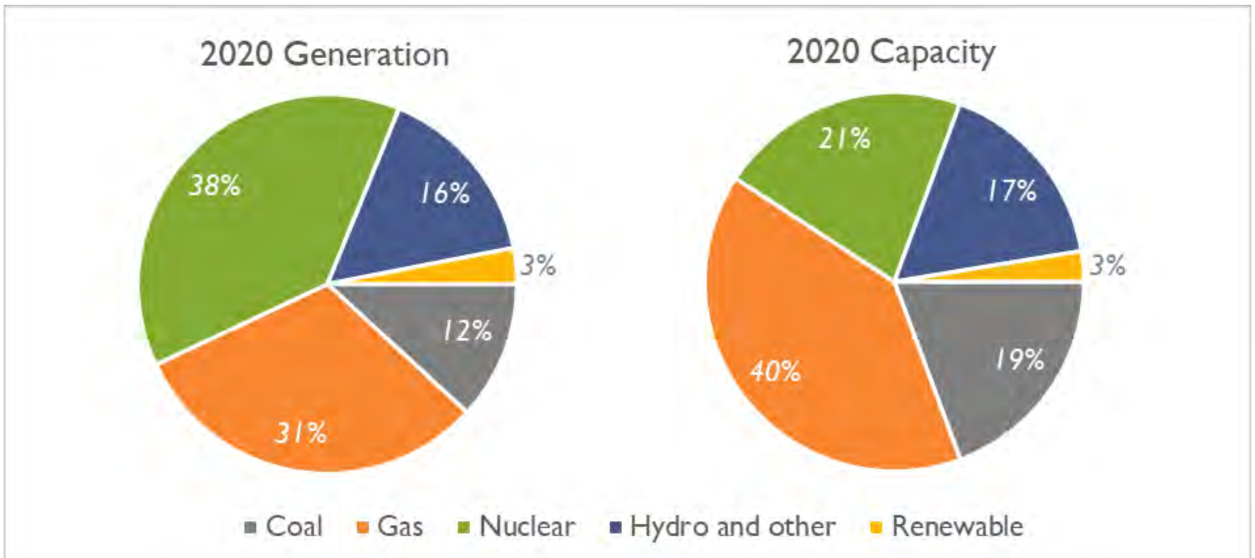
- **Land-use impacts in the Tennessee Valley can be minimized through an emphasis on distributed resources.** We found that to achieve the level of utility-scale solar in the 100% Clean Energy scenario, each county in TVA's service territory would need to build the equivalent of just 480 MW solar facilities, or roughly two large solar farms. Meanwhile, to achieve the level of distributed solar assumed in the 100% Clean Energy scenario, only 4 percent of rooftops in the Tennessee Valley would need to add solar. An increase in that portion of rooftop solar could minimize the utility-scale solar impacts on land use.

This report closes with recommendations for future modeling efforts. We view this analysis as a guide for future analytical efforts, including those performed by TVA in the integrated resource planning (IRP) process that we expect to begin in 2023.

1. TVA'S ROLE IN THE CLEAN ENERGY TRANSITION

Tennessee Valley Authority (TVA) is a federally owned electric utility and the largest provider of public power in the United States. U.S. Congress created TVA in 1933 to, "provide for the agricultural and industrial development" of the Tennessee River Valley.[2] Today, 90 years since its founding, TVA remains a critical source of power and economic development in the region. TVA's electric generation fleet is the sixth-largest in the country, with over 66 GW of generation capacity under its control.[3] Figure 2 shows the generation and capacity for TVA's service territory in 2020.

Figure 2. Recent generation and capacity in TVA's service territory



Note: This figure includes generation and operational capacity from all resources within TVA's service territory, including those resources not necessarily owned by TVA. "Hydro and other" includes hydro, biomass, and miscellaneous resources. "Renewable" includes solar, wind, and battery storage resources.

After working to electrify the Tennessee Valley through the 20th century, TVA now has an opportunity to make a new transformation. Like many of its peer utilities, TVA has publicly committed to take advantage of cost-effective, zero-carbon resources and reduce its carbon emissions from power generation. TVA's carbon commitment targets a 70 percent reduction of carbon dioxide (CO_2) by 2030, 80 percent by 2035, and net-zero aspiration by 2050. President Biden's ambition to completely decarbonize the United States' electric generation by 2035 adds even more urgency to TVA's zero-

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[2] See https://www.tva.com/about-tva/our-history.

[3] For more information on TVA's climate goals, see its "Carbon Report" web page, available at https://www.tva.com/environment/environmental-stewardship/sustainability/carbon-report.

carbon commitment.[4] At a minimum, TVA's journey toward a zero-carbon grid will entail a transition away from TVA's legacy coal fleet and an ambitious deployment of zero-carbon technologies like solar, wind, and energy storage. Notably, TVA leadership has suggested that existing technology can get the utility to reduce carbon emissions by 80 percent by 2035, but that technology will need to evolve in order to achieve 100 percent decarbonization.[5]

TVA's decisions will impact future ratepayers as well as today's national decarbonization trends. As its aging coal fleet reaches the end of its useful life, TVA must decide whether to chart a course for clean energy development or continue with its legacy utilization of fossil resources. In January 2023, TVA indicated it would replace a retiring coal plant with a 1,450-MW gas generator.[6] Status quo decisions like this one will lock TVA into a future dependent on fossil fuels, and thereby burden the region with the associated detrimental impacts to consumer wallets, public health, and pollution.

As TVA and utilities across the country continue their transition toward less carbon-intensive energy sources, clean energy technologies are creating new options and pathways for serving the grid. Distributed energy resources promise to play a greater role than ever before. Rooftop solar and distributed energy storage technologies provide zero-carbon electricity directly at the point of use, which could avoid or defer capital-intensive investments in distribution and transmission infrastructure and also lead to increases in jobs within the Valley. Demand-side management programs also allow customers unprecedented control over their own usage so they can reduce their own bills while generating savings for the grid as a whole. Together, distributed energy resources provide a unique service to the grid and will be a critical source of flexibility as the power system integrates more variable renewable energy.[7]

As entrepreneurs, ratepayers, and policymakers contemplate transitioning from carbon-emitting technologies to clean energy across the entire Tennessee Valley economy, the electricity grid's role will be even more critical as a source of zero-carbon energy across an expanded set of sectors and end uses. Switching from fossil fuels to electricity across heating, transport, and heavy industry will also bring new benefits to the community. These benefits include less local pollution; less dependence on volatile fuel

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[4] The White House. April 22, 2021. *FACT SHEET: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies*. Available at https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/.

[5] Tennessee Valley Authority (2021). TVA Charts Path to Clean Energy Future. Retrieved at: https://www.tva.com/newsroom/press-releases/tva-charts-path-to-clean-energy-future.

[6] "TVA Retiring Cumberland, Continues Transition to Clean Energy Future." Press Release. TVA. January 10, 2023. Available at https://www.tva.com/newsroom/press-releases/tva-retiring-cumberland-continues-transition-to-clean-energy-future; *A Clean Energy Portfolio Is Still the Best Option for TVA*. Synapse Energy Economics. January 2023. Available at https://www.synapse-energy.com/sites/default/files/Synapse%20Response%20to%20Concentric%20Report.pdf.

[7] Shen, B., Kahrl, F., & Satchwell, A. (2021). Facilitating Power Grid Decarbonization with Distributed Energy Resources: Lessons from the United States. Retrieved at: https://emp.lbl.gov/publications/facilitating-power-grid.

commodities; and local economic development in sectors that construct, install, and maintain new, electricity-powered equipment. This report describes cutting-edge modeling and analysis to envision an electrified Tennessee Valley and project its impacts on the economy and electric grid.

Economy-wide decarbonization and electrification inverts the conventional wisdom that electricity use will continue to grow at a low, stable rate. High-quality national decarbonization models project that, across the United States, total electricity demand could more than double between now and 2050.[8] Despite these authoritative projections, TVA's last long-term planning process (its 2019 integrated resource planning, or IRP, process--described below) did not include any meaningful consideration of electrification despite its potentially dramatic impact on how electricity is generated, transmitted, distributed and used. As TVA plans to decarbonize its energy supply, it must also plan for integrating increasing demand for zero-carbon electricity from other sectors.

Faced with a rapidly changing energy landscape, TVA should be developing a long-term plan for meeting the Tennessee Valley's energy needs reliably, affordably, and sustainably. TVA's planning choices will impact both TVA's own decarbonization pathway and the broader economy across the Tennessee Valley. Responsible energy planning should account not only for how TVA's energy portfolio serves the electric grid, but also its impacts on economic development and land and water resources. Ensuring that TVA is charting a pathway to decarbonization that is most beneficial for the Tennessee Valley requires even-handed consideration of each of these impacts.

1.1. Integrated resource planning: A roadmap for TVA's energy future

TVA updates its roadmap for energy resources every few years through the development of its IRP.[9] Integrated resource planning is the industry-standard method that utilities use to plan for the future: they assess future grid needs over the next 20 years; explore inventory supply- and demand-side resources available to meet those needs; and then make plans to build or procure energy resources to meet grid needs while also satisfying reliability, affordability, and environmental standards.

As a federally owned public entity, TVA's IRP process is unique. Most utilities submit draft IRPs to state regulators, who review the plan and make a judgment about whether the utility's plan is in the public interest and identify any needed revisions. In TVA's case, its IRPs proceed like many other federal agency decisions: TVA develops and issues a draft IRP and environmental impact statement (EIS), which initiates a period of public review, consultation, and comment. After the comment period, the presidentially

[8] Larson, E., C. Greig, J. Jenkins, E. Mayfield, A. Pascale, C. Zhang, J. Drossman, R. Williams, S. Pacala,R.Socolow, EJ Baik, R. Birdsey, R. Duke, R. Jones, B. Haley,E. Leslie, K.Paustian, and A. Swan, (2021, October). Net-Zero America: Potential Pathways, Infrastructure, and Impacts, Final report, Princeton University. Retrieved at: https://www.dropbox.com/s/ptp92f65lgds5n2/Princeton%20NZA%20FINAL%20REPORT%20%2829Oct2021%29.pdf?dl=0.

[9] TVA's statute does not have a requirement that IRPs be conducted on a set schedule. Previous IRP processes have been conducted in 2019, 2015, and 2011.

appointed TVA Board of Directors revises and adopts the IRP.[10] In addition to the goal of providing low-cost, reliable, and clean electricity, TVA's IRPs have a goal of identifying an energy resource plan that performs well under a variety of future conditions, taking into account cost risk, environmental stewardship, operational flexibility, and Valley economics.[11]

The Inflation Reduction Act and the Tennessee Valley Authority

Signed into law in August 2022, the *Inflation Reduction Act* (IRA) includes an ambitious set of climate and clean energy provisions that promise to further transform the energy landscape. The historic law, representing $369 billion in funding, targets cutting U.S. greenhouse gas emissions roughly 40 percent by 2030.[12] While TVA's identity as a publicly owned entity has historically excluded it from taking advantage of tax credits on clean energy investments, specific provisions of the IRA will unlock access to clean energy incentives for TVA. The IRA will have wide-ranging impacts on the U.S. energy economy, including in the Tennessee Valley. Taking advantage of the IRA's provisions in the short term should be a priority for energy resource planning in the Tennessee Valley and across the country. The following IRA programs present big opportunities for TVA's energy future (Appendix 1 details how we included these tax credits and investment subsidies in our modeling):

- **Refundable clean energy tax credits:** technology-neutral clean energy investment tax credits (for which standalone storage is newly eligible) and production tax credits (for which solar is newly eligible) with a 10-year lifespan; TVA is now eligible for direct refunds, which will enable it to monetize these credits.
- **Incentives for building energy efficiency and electrification:** two new major rebate programs to support home energy retrofits, through which the seven states served by TVA have been allocated $1.2 billion of funding altogether;[13] the IRA expanded and extended existing tax credits for residential and commercial building improvements.[14]
- **Accelerating transmission buildout:** $2 billion in funding for national-interest electric transmission facilities and $760 million for studying transmission impacts; this will complement the "Building a Better Grid" initiative, a program funded by the Infrastructure Investment and Jobs Act (IIJA) that aims to catalyze nationwide development of high-capacity transmission lines.
- **Energy Infrastructure Reinvestment Program:** $5 billion to guarantee up to $250 billion in loans to replace retired infrastructure or enable operating infrastructure to reduce emissions, e.g., by refinancing undepreciated assets.[15]
- **Electric vehicle funding:** individuals and businesses purchasing new or used electric vehicles are eligible for electric vehicle rebates, including a $7,500 rebate for new electric cars under $55,000.

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[10] IRP Record of Decision: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/irp/irp_rod_published_9-17-19_in_fed_reg_201920104.pdf?sfvrsn=a53fe867_4.

[11] 2019 Integrated Resource Plan. Volume I – Final Resource Plan. TVA. June 2019. Available at https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/irp/2019-documents/tva-2019-integrated-resource-plan-volume-i-final-resource-plan.pdf?sfvrsn=44251e0a_4. See also TVA's statutory requirement for least-cost planning: U.S. Code 16 (2021), § 831m-1. www.govinfo.gov/app/details/USCODE-2021-title16/USCODE-2021-title16-chap12A-sec831m-1.

[12] Jenkins, J.D., Mayfield, E.N., Farbes, J., Jones, R., Patankar, N., Xu, Q., Schivley, G., "Preliminary Report: The Climate and Energy Impacts of the Inflation Reduction Act of 2022 ," REPEAT Project, Princeton, NJ, August 2022.

[13] Energy.gov, (2022). Biden-Harris Administration Announces State and Tribe Allocations for Home Energy Rebate Programs. Available at: https://www.energy.gov/articles/biden-harris-administration-announces-state-and-tribe-allocations-home-energy-rebate.

[14] Ungar, L., and S. Nadel. (2022). Home Energy Upgrade Incentives: *Programs in the Inflation Reduction Act and Other Recent Federal Laws*. Washington, DC: American Council for an Energy-Efficient Economy. www.aceee.org/policy-brief/2022/09/home-energy-upgrade-incentives-programs-inflation-reduction-act-and-other.

[15] O'Boyle, M., Solomon, M. (2022, August 24). "Inflation Reduction Act Benefits: Billions in Just Transition Funding for Coal Communities." *Forbes*. Available at: https://www.forbes.com/sites/energyinnovation/2022/08/24/inflation-reduction-act-benefits-billions-in-just-transition-funding-for-coal-communities/?sh=6e22963d6ebd.

While IRPs were initially adopted by the electric utility industry as a response to nuclear cost over-runs and fossil supply constraints, today they are used to plan for a whole new set of transitions in the energy sector.[16] An IRP's long time horizon (typically 20 years or more) brings medium- and long-term carbon emissions goals into focus, and the integration of electricity demand and supply provide an opportunity to synchronize electricity supply with electrification across the economy. In the context of economy-wide decarbonization, IRPs provide an opportunity to look at the big picture and plot a path forward. TVA's most recent IRP was finalized in September 2019, with a direction to update the IRP no later than 2024. TVA's next IRP will be the first one since TVA's announcement of an 80 percent reduction in carbon emissions by 2035 and net-zero emissions by 2050, and the first since President Biden's executive order to decarbonize the electricity supply by 2035. TVA's next IRP represents a critical opportunity to chart a pathway toward achieving those goals while supporting economy-wide decarbonization and continuing to deliver affordable, reliable power to TVA ratepayers.

1.2. Synapse's approach

In this report, Synapse Energy Economics explores several pathways for TVA's energy future. Synapse's approach is anchored by the EnCompass capacity expansion and production cost modeling software, which allows Synapse to model the TVA electricity system in detail and ensure that resource pathways optimize costs and maintain system reliability.[17] Synapse has developed robust forecasts of electricity demand in the context of increasing electrification and used up-to-date, industry-standard cost forecasts for new resources to ensure that Synapse's results are consistent with real-world outcomes.

In turn, we have assessed the impact of optimized resource portfolios generated by EnCompass on topics that are meaningful to TVA ratepayers, including impacts to rates and bills, energy burden, local economic development, public health, land use, and water use. These additional dimensions provide a fuller picture of what the energy transition will mean for the Valley, and the tradeoffs that might exist between different resources and pathways. Importantly, our analysis highlights that TVA's energy pathway has wide-ranging impacts across the people and economy of the Tennessee Valley.

In 2023, TVA will release its own draft IRP that charts its own proposed pathways for providing clean, affordable, and reliable power in the public interest. As TVA and interested stakeholders deliberate on their vision for TVA's energy portfolio, this study can provide an initial, independent assessment of potential energy futures for the TVA and the Tennessee Valley.

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[16] For more information on IRP history and best practices, see *Best Practices in Electric Utility Integrated Resource Planning.* Synapse Energy Economics. June 2013. Available at https://www.synapse-energy.com/sites/default/files/SynapseReport.2013-06.RAP_.Best-Practices-in-IRP.13-038.pdf.

[17] We note that in May 2022, Synapse published a report *Clean Portfolio Replacement at Tennessee Valley Authority* (available at https://www.synapse-energy.com/sites/default/files/TVA_Clean_Portfolio_Modeling_21-097_0.pdf). This analysis, while similar conceptually, differs from that previous work in several ways. Notably, it is inclusive of the effects of the Inflation Reduction Act (which did not exist at the time of the prior report's printing, conducts analysis through 2050 (rather than 2042), and envisions a future Tennessee Valley with more ambitious levels of electrification and decarbonization.

2. ANALYSIS

Synapse's exploration of a clean energy future for TVA relied on the comparison of several scenarios. These scenarios present several visions of the future, with different assumed values for electricity demand and electrification, availability of clean energy and demand-side resources, modifications to TVA's approach to reserve margins, and requirements for electric sector emission reductions. Within each scenario, we evaluated the least-cost approach for TVA to reliably meet its customers' electricity needs, and then we estimated the impact on the electric sector and other sectors of the economy.

2.1. Methodology

Our approach for analyzing the impacts of decarbonizing TVA and end uses in its service territory involved a number of tools (see Figure 3). At the heart of our analysis was the use of an electric-sector capacity expansion and production cost model, EnCompass. Developed by Anchor Power Solutions, EnCompass is a single, fully integrated power system platform that allows for utility-scale generation planning and operations analysis, and it is widely used by utilities across the country for IRP planning. Synapse populated the model using the EnCompass *National Database*, created by Horizons Energy, and supplemented this dataset with additional publicly available information to provide further detail on power plant characteristics, resource costs, and fuel prices. EnCompass was used to produce outputs related to generation, capacity, emissions, and system costs, based on least-cost optimization.

This analysis also relied on a number of other tools for developing metrics relevant to the transportation, buildings, and industrial sectors. Several of these metrics (such as avoided tailpipe emissions) are outputs in their own right; others become inputs into the EnCompass model or another analytical tool. Four such tools utilized in this project were Synapse's Electric Vehicle Regional Demand Impacts (EV-REDI) tool, Synapse's Building Decarbonization Calculator (BDC), U.S. EPA's Energy Savings and Impacts Scenario Tool (ESIST), developed by Synapse, and U.S. DOE's EVI-Pro Lite tool.[18]

Synapse used each of these tools to generate costs and cost deltas between scenarios. We combined data related to costs with job-per-million-dollar-spent factors generated from the IMPLAN model and other inputs to generate estimates of job changes over time.[19]

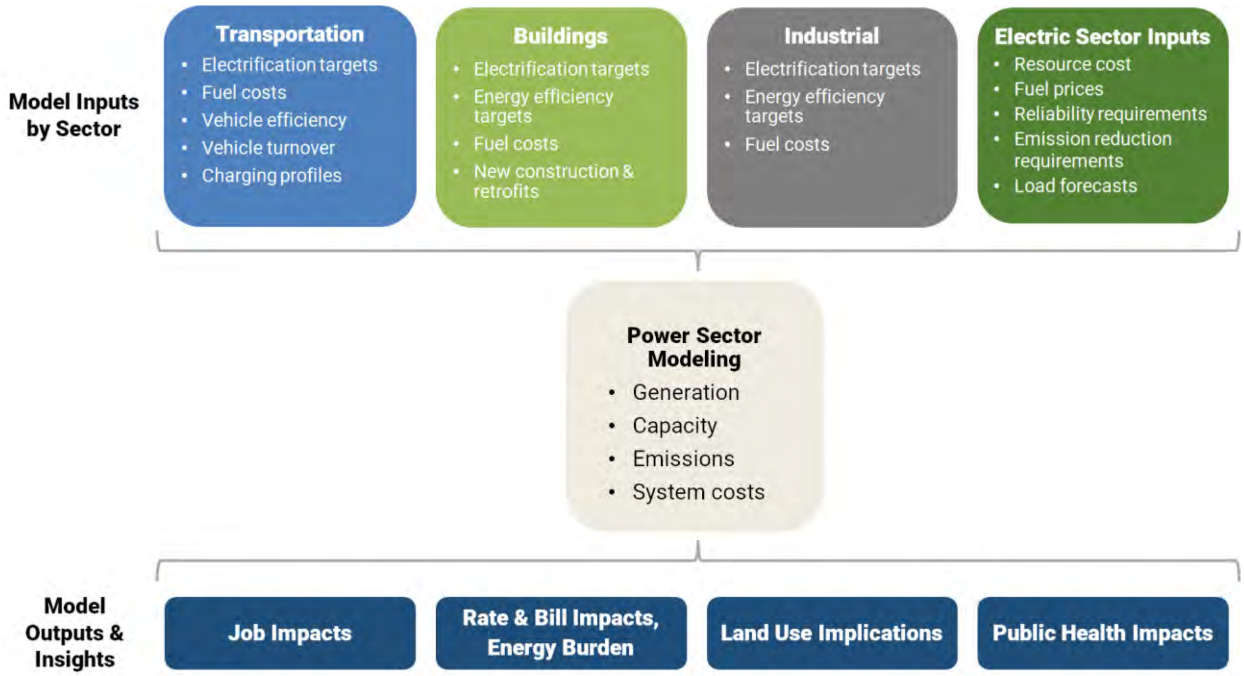
Many of these tools also generate changes to emissions of criteria pollutants that impact human health, including nitrogen oxide (NO_X), sulfur dioxide (SO_2), particulate matter ($PM_{2.5}$), volatile organic compounds (VOC), and ammonia (NH_3). Data on how emissions of these pollutants vary between

[18] For more information on EV-REDI and BDC, please see https://www.synapse-energy.com/tools/electric-vehicle-regional-emissions-demand-impacts-tool-ev-redi and https://www.synapse-energy.com/tools/building-decarbonization-calculator. For more information on ESIST, see https://www.epa.gov/statelocalenergy/energy-savings-and-impacts-scenario-tool-esist. For more information on EVI-Pro Lite, see https://afdc.energy.gov/evi-pro-lite.

[19] For more information on the IMPLAN model, see https://implan.com/.

scenarios was passed through U.S. EPA's CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA) to estimate how emission dispersion varies, and how this change could impact public health.[20]

Figure 3. Diagram of modeling tools



2.2. Modeled scenarios

Table 3 describes the scenarios modeled in this study, and the primary differences among them. Our three scenarios were:

- <u>TVA Baseline</u>: Models a status-quo approach to a future TVA. This is a scenario that builds on the "Current Outlook" modeling conducted by TVA in its 2019 IRP, but allows TVA to procure cost-effective renewables enabled, in part, by the passage of the Inflation Reduction Act of 2022.
- <u>100% Clean Energy</u>: Requires a transition to 100 percent clean energy by 2035 and expands electrification and demand-side resources.
- <u>Ambitious DER</u>: Envisions even further demand-side resource options.

All three scenarios modeled in this analysis utilize the same set of assumptions, with only five main differences. The first is the required electric sector emission reductions: the 100% Clean Energy scenario and Ambitious DER scenario require electric-sector emissions to be reduced by 80 percent by 2030 and

[20] For more information on COBRA, see https://www.epa.gov/cobra.

100 percent by 2035 (relative to 2005 levels), whereas the TVA Baseline scenario has no such requirement. Second, the TVA Baseline case assumes low levels of energy efficiency and transformational electrification in line with the "Current" case of TVA's recent 2019 IRP.[21] Meanwhile, the 100% Clean Energy and Ambitious DER case assume that energy efficiency levels ramp up to those observed by leading neighboring states like Arkansas, reaching levels of 1.5 percent per year (as a percent of previous year retail electricity sales) by 2029. These two scenarios also assume high levels of electrification of the transportation, buildings, and industrial sectors. Specifically:

- For the transportation sector, we assumed that 100 percent of light-duty vehicle sales are electric vehicles (EV) by 2030. We also assumed that 60 percent of medium- and heavy-duty vehicle sales are EVs by 2030 and 100 percent of these vehicle sales are EVs by 2038. Vehicle sales trajectories follow a conventional S-curve for technological adoption; vehicle stock (and implied impacts on tailpipe emissions and electricity load) lag vehicle sales according to vehicle turnover. For more information on Synapse's methodology for modeling EVs, see https://www.synapse-energy.com/tools/electric-vehicle-regional-emissions-demand-impacts-tool-ev-redi. This analysis made no assumptions regarding the emissions impacts related to non-road vehicles (e.g., airplanes, boats, rail, etc.).

- For the residential and commercial buildings sector, we assumed that 100 percent of new sales of space heating, water heating, cooking, and drying equipment are electric by 2030. This is primarily achieved through the use of high-efficiency heat pumps. For more information on Synapse's methodology for modeling electrification in the building sector, see https://www.synapse-energy.com/tools/building-decarbonization-calculator. Importantly, because many customers in TVA's footprint currently heat their homes and business with inefficient electric resistance heating, a switch to more efficient heat pumps leads to a *reduction* in annual electricity requirements. When this phenomenon is coupled with the electrification impacts of switching fossil-fuel-powered end uses (such as natural gas-fired furnaces) out for heat pumps, we observe effectively no net change in annual electricity requirements.

- For the industrial sector, we assumed that 80 percent of end uses currently relying on fossil fuels are electrified by 2050, with the shift beginning in 2030. These adoptions follow the same S-curve for technological adoption described above. As of the time of this study, data on the amount of electricity required to decarbonize industrial end uses remains sparse. This analysis assumed that 230 TWh of wholesale electricity are required for every 1 quadrillion Btu of current fossil fuel end use.[22] This analysis also assumed that the amount of electricity required for direct use by industrial customers and other large customers remains constant throughout the study period.

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[21] See TVA's 2019 IRP at https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/irp/2019-documents/tva-2019-integrated-resource-plan-volume-i-final-resource-plan.pdf?sfvrsn=44251e0a_4, Appendix E.

[22] This assumption is derived from data described in Energy Innovation's *NDC Pathway* scenario in their Energy Policy Simulator. More information is available at https://us.energypolicy.solutions/scenarios/home.

Third, the scenarios differ in terms of the assumed distributed energy resources. The TVA Baseline case assumes the same levels of distributed solar and distributed storage assumed in the "Base" case of TVA's 2019 IRP. The 100% Clean Energy scenario assumes levels in line with the "Medium" case, and the Ambitious DER scenario assumes levels in line with the "High" case. Fourth, the scenarios feature different levels of demand response and flexible load. All three scenarios include the amount of demand response assumed in the "Current" case of TVA's 2019 IRP. The Ambitious DER scenario also includes an additional quantity of "flexible load," meant to represent load-shifting of newly electrified end uses (see page 37 for more information).

Finally, the scenarios feature different reserve margin assumptions. The TVA Baseline scenario maintains TVA's current reserve margins throughout the study period. Meanwhile, the other two scenarios assume a change to winter reserve margins, such that TVA features a single year-round 17 percent reserve margin beginning in 2024.

Table 3. Differences between modeled scenarios

	TVA Baseline	100% Clean Energy	Ambitious DER
Required electric sector CO_2 emissions reductions	None	80% by 2030, 100% by 2035 *(relative to 2005)*	Same as 100% Clean Energy
Electrification and energy efficiency	Minimal electrification and energy efficiency according to 2019 TVA IRP	Ambitious electrification and energy efficiency aimed at economy-wide decarbonization by 2050	Same as 100% Clean Energy
Distributed energy	Follows "Base" case in 2019 IRP: DG PV: 1.2 GW (2030); 2.7 GW (2050) DG storage: None	Follows "Medium" case in 2019 IRP: DG PV: 1.7 GW (2030); 4.4 GW (2050) DG storage: 25 MW (2030); 270 MW (2050)	Follows "High" case in 2019 IRP: DG PV: 2.1 GW (2030); 6.3 GW (2050) DG storage: 180 MW (2030); 1.1 GW (2050)
Demand response and flexible load	Follows 2019 IRP: 1.9 GW conventional DR (2050)	Follows 2019 IRP: 1.9 GW conventional DR (2050)	1.9 GW conventional DR (2050) 32 GW flexible load (2050) (*Components of flexible load vary by duration and price paid*)
Changes to reserve margins	No changes to current TVA requirements (17% summer, 25% winter)	Assumes year-round 17% reserve margin beginning in 2024	Same as 100% Clean Energy

All other assumptions related to topology, modeling horizon, load forecasts, load shapes, resource costs and characteristics, transmission, and capacity contributions were the same in all scenarios. See Appendix A for more detail on assumptions.

2.3. Results

The following section describes the results of our scenario analysis, with a main focus on the TVA Baseline and 100% Clean Energy scenarios (page 37 provided detail on the Ambitious DER scenario).

CO_2 emissions

The TVA Baseline scenario, which features no CO_2 reduction requirements, nevertheless sees a marked decrease in electric sector CO_2 emissions. In the mid-2020s and early 2030s this is primarily driven by a decrease in coal generation linked to coal plant retirements. In the second half of the study period, this is largely driven by new wind and solar resources displacing generation from gas plants. By 2050, electric sector CO_2 emissions in the TVA Baseline scenario are 99 percent lower than 2005 emissions, indicating that this level of emissions reduction is achievable based on economics alone (see Figure 4).

The 100% Clean Energy scenario features a requirement for CO_2 reductions to fall by 80 percent by 2030 and 100 percent by 2035 and all later years, in line with TVA's own announced aspirational goals. This requirement proves to be binding in most year it is applied, with CO_2 emissions decreasing rapidly in the late 2020s through 2035. This is driven by new wind and solar resources entirely displacing existing coal and gas resources by 2035.

The two scenarios feature radically different trajectories for all-sector emissions in TVA's footprint (see Figure 5). By 2050, the TVA Baseline scenario reaches a 41 percent reduction in economy-wide emissions (relative to 2020 levels), reflecting the fact that while the electric sector is nearly decarbonized, emissions from other sectors have remained largely flat. In contrast, the 100% Clean Energy scenario reduces economy-wide emissions by 92 percent, demonstrating the results of an economy-wide decarbonization strategy.

Figure 4. Electric sector CO_2 emissions

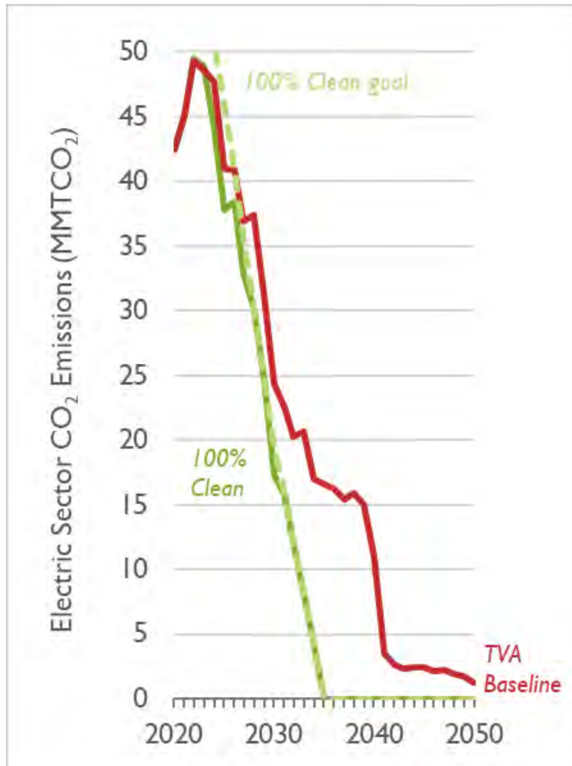
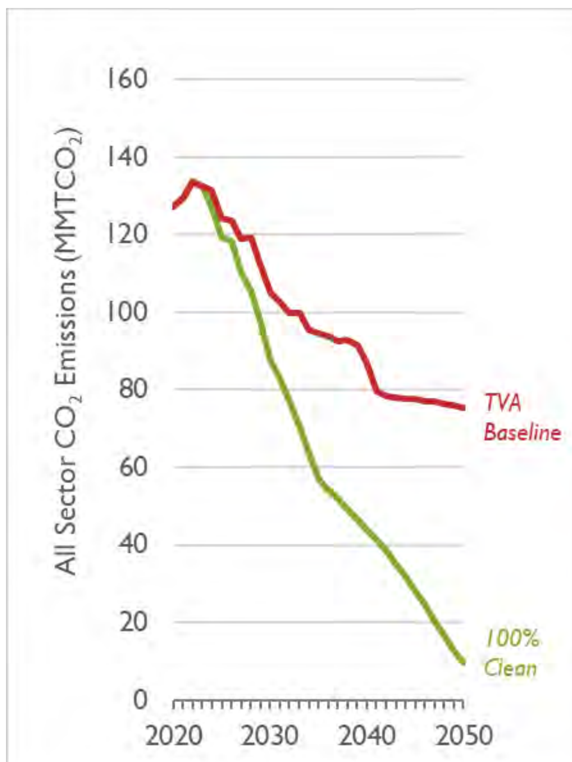


Figure 5. All sector CO_2 emissions



Annual load and generation

The TVA Baseline scenario is characterized by largely flat load over the study period, commensurate with a lack of planned electrification (see Figure 6). On the generation side, we observe coal generation decreasing during the mid-2020s, and falling to zero by 2035, in line with planned coal retirements. Generation from clean energy is relatively small until the mid-2030s, when new wind and solar plants are added to replace energy from retiring coal and gas plants. This clean energy continues to displace more and more existing fossil energy in every year. By the mid-2040s, over 95 percent of system generation is produced from non-fossil resources. By the end of the study period, about 12 percent of generation is dedicated to charging battery storage resources.

In contrast, the 100% Clean Energy scenario is characterized with relatively flat load through 2030, followed by rapidly increasing load in response to electrification (see Figure 7). By 2050, load (not inclusive of energy storage charging demands) is two times higher than present day. This increase in load is primarily met through increasing solar and wind generation, which arrives earlier (compared to the TVA Baseline scenario) in order to displace fossil fuels and meet the CO_2 reduction requirements modeled in this scenario. This solar and wind generation is balanced with substantial battery storage resources—by 2050, the charging requirements for these resources comprises 19 percent of system generation.

In the 100% Clean Energy scenario, the model relies solely on solar, wind, battery storage, hydro, and nuclear resources to successfully meet electricity demand for 16 modeled years.

Figure 6. TVA Baseline generation and load

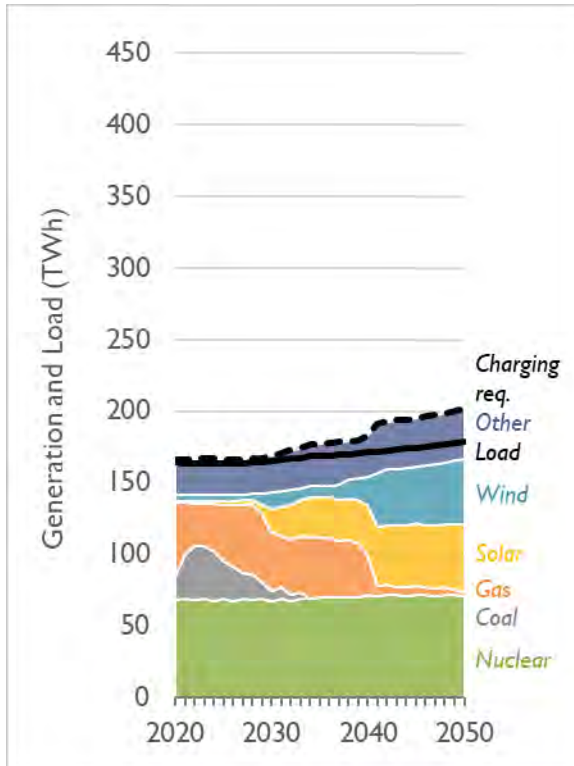
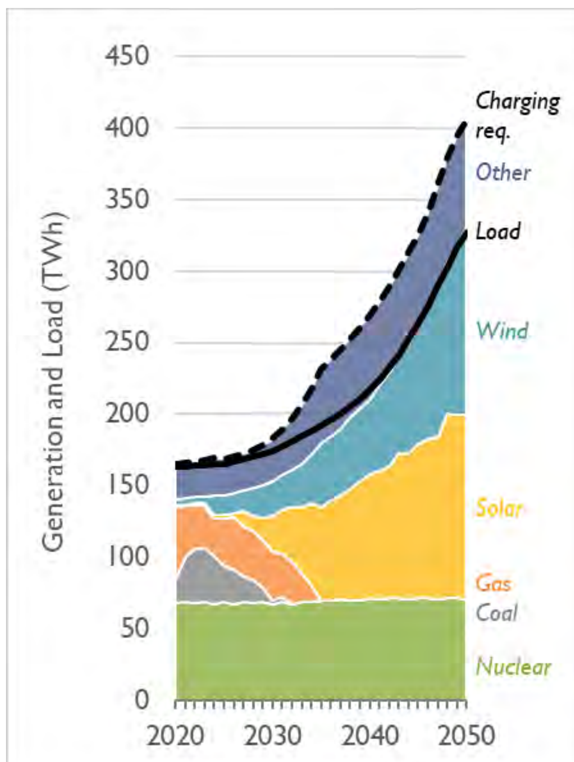


Figure 7. 100% Clean Energy generation and load



Capacity changes

In the TVA Baseline scenario, the period through the mid-2030s is marked by planned coal plant retirements, with some coal plants retiring one or two years ahead of schedule due to economic forces (see schedule of assumed coal retirement dates in Table 4). Additions of new clean energy are rare until the early 2030s, in part because of the assumed levels of low load growth. New clean energy is then added in several waves in the early 2030s, early 2040s, and late 2040s, typically occurring as renewable costs shift and these resources become more economic (see Figure 9). In the 2040s, these renewables begin to displace more and more generation from gas plants, causing those less-economic plants to retire as they are used less frequently. By 2050, 34 GW of solar is added, alongside 3 GW of distributed solar, 13 GW of wind, and 9 GW of battery storage.

The 100% Clean Energy scenario features a similar trend for coal retirements, but it has an accelerated trend for clean energy additions. Solar, wind, and battery storage are added rapidly beginning in the late 2020s, in response to this scenario's CO_2 reduction requirement (see Figure 8 and Figure 10). This same dynamic drives gas plant retirements, with all but 1 GW retired by 2035.

In all scenarios, we assumed a 5-GW maximum buildable amount independently for each new type of clean energy resource (wind, utility-scale solar, and utility-scale battery storage), meant to reflect limitations in in resource construction and supply chains. We found that

Table 4. Coal unit retirement assumptions

Unit Name	Nameplate Capacity (MW)	Assumed Retirement Date
Bull Run 1	870	December 2023
Cumberland 1	1239	December 2026
Cumberland 2	1231	December 2028
Kingston 1	132	December 2026
Kingston 2	132	December 2026
Kingston 3	132	December 2026
Kingston 4	132	December 2027
Kingston 5	174	December 2027
Kingston 6	174	December 2027
Kingston 7	174	December 2027
Kingston 8	174	December 2027
Kingston 9	174	December 2027
Gallatin 1	225	December 2031
Gallatin 2	225	December 2031
Gallatin 3	263	December 2031
Gallatin 4	263	December 2031
Shawnee 1	134	December 2033
Shawnee 2	134	December 2033
Shawnee 3	134	December 2033
Shawnee 4	134	December 2033
Shawnee 5	134	December 2033
Shawnee 6	134	December 2033
Shawnee 7	134	December 2033
Shawnee 8	134	December 2033
Shawnee 9	134	December 2033
Shawnee 10	124	December 2033
Paradise 3	971	Retired in 2020
Red Hills Generating Facility	440	December 2031

Notes: The assumed retirement dates of the Cumberland units are intended to reflect the uncertainty in TVA's retirement announcement known at the outset of this modeling project (i.e., the units would retire as early as 2026 and no later than 2030). The assumed retirement dates of the Kingston units also reflect the uncertainty of TVA's announcement (3 units as early as 2026, but no later than 2031, and the remaining 6 units as early as 2027, but no later than 2033). The Red Hills Generating Facility is a PPA which is assumed to expire in December 2031.

this assumed 5-GW cap is sometimes binding for wind in the 2040s. Wind capacity is added throughout the study period, reaching 41 GW in 2050. On average, 1.5 GW of wind is built per year. Just 6 percent of wind additions are in the TVA footprint, highlighting the advantages of procuring wind power from outside the Valley. This is in spite of accounting for the cost of new transmission lines outside the region (totaling $45 billion in the 100% Clean Energy scenario). Together, these new lines facilitate over 130 TWh of wind from outside of the Valley.

Solar capacity additions occur in every single year after 2025, with the 5-GW cap being frequently binding, and 4 GW built per year on average. Throughout the study period, 2 GW of battery storage is built per year for a total of 46 GW. One-quarter of this is 50-hour storage, which is almost all built after 2040.

Figure 8. Clean energy additions in the 100% Clean Energy scenario

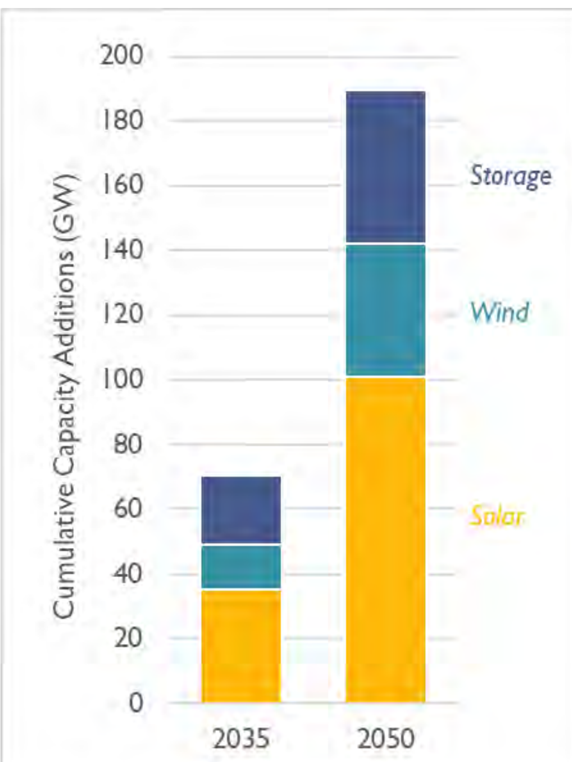


Figure 9. TVA Baseline additions and retirements

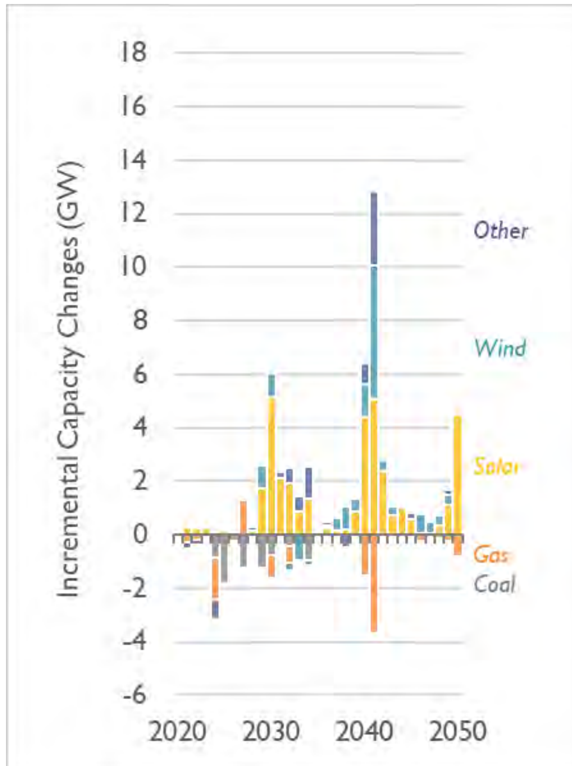
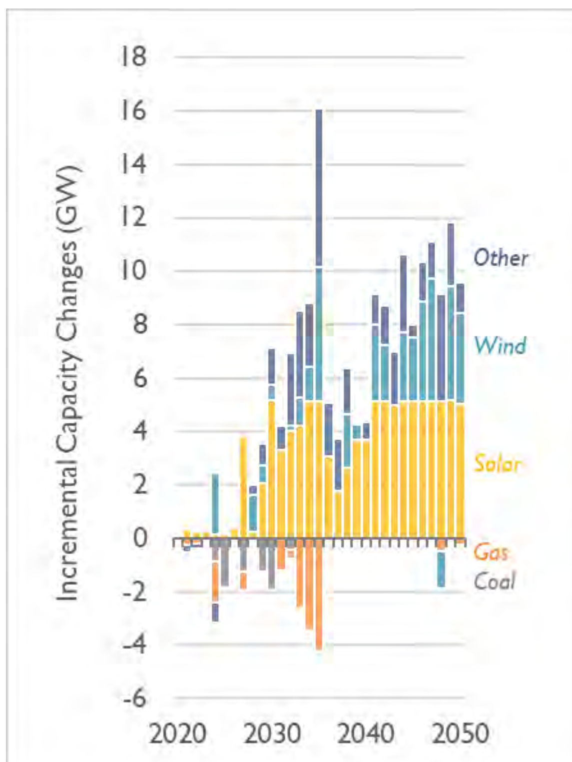


Figure 10. 100% Clean Energy additions and retirements



Firm capacity

The TVA Baseline assumes present-day TVA reserve margins remain static through 2050. In other words, this scenario assumes that today's 25 percent reserve margin for winter months and 17 percent reserve margin for summer months persists through the future.

In contrast, the 100% Clean Energy scenario assumes that TVA moves to a year-round reserve margin of 17 percent beginning in the winter of 2024/2025. In our view, TVA currently relies on an inflated winter reserve margin, as its own analysis suggests that it needs a greater energy reserve in the winter to meet potential winter demand issues. We believe that TVA's winter reserve margin is inflated because (1) winter heating is largely driven by inefficient electric resistance systems, which create large and immediate power draws and leave TVA susceptible to potential demand issues, and (2) TVA's thermal resources, like all thermal resources, are not 100 percent dependable in the winter. Winter conditions can cause supply issues related to fuel deliverability and further decrease the performance of coal and gas generators. To compensate, TVA requires a higher level of energy reserves in winter to meet potential winter demand.

Our 100% Clean Energy scenario shifts away from this paradigm. As we electrify demand-side resources, highly efficient electric heat pumps replace inefficient electric resistance heating, thereby reducing winter peak demand issues. Secondly, an increase in renewable resources increases grid reliability. Wind resources have high contributions in winter months, and solar often ramps up in the morning to meet midday peaks. Regardless, in order to be conservative, both scenarios assume the same set of today's assumptions for capacity contributions (see Appendix A for further detail about these assumptions).

We observe that both scenarios safely meet reserve margins in every year, for both seasons (see Figure 11 and Figure 12). In addition, we observe that the summer reserve margin constrains the model and drives resource additions from about 2025 through 2030 as coal plants retire. In the TVA Baseline scenario, from 2030 on, the winter reserve margin constrains the model. This occurs as solar becomes a dominant new type of resource addition and features only a very small winter capacity contribution of 1 percent, causing the model to build additional capacity (typically storage resources) to meet the firm capacity requirements.

Meanwhile, in the 100% Clean Energy scenario, after the mid-2030s both winter and summer requirements cease to constrain the model, meaning the importance of firm capacity (as the metric is designed today) fades. This occurs as the model builds more variable-dispatch wind and solar and more storage. During this period, the model is increasingly focused on complying with multi-day energy requirements, rather than a single seasonal peak. This highlights the increasing need to reconsider conventional approaches for planning for capacity requirements in light of an increasingly changing electricity system.

Figure 11. Winter firm capacity and reserve margins

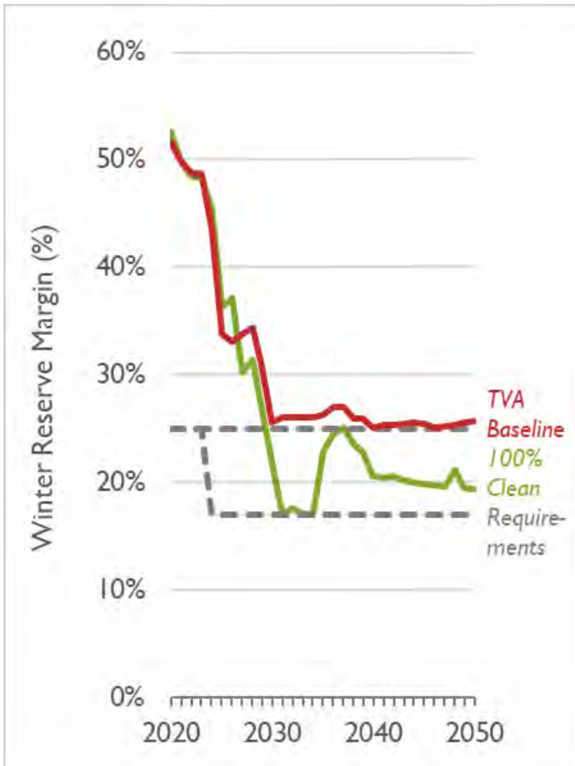
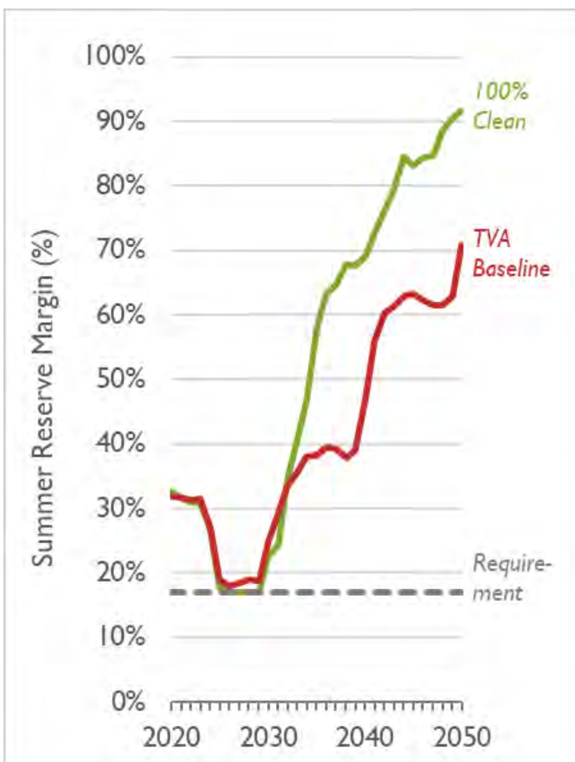


Figure 12. Summer firm capacity and reserve margins



Our analysis suggests the least-cost approach for TVA to both meet customer demand and decarbonize avoids the construction of new fossil resources. Contrary to this, TVA recently approved a proposal to replace the retiring Cumberland plant with a new, 1,450-MW gas plant. Coincidentally, our TVA Baseline scenario, a scenario which represents a future in which TVA does not adhere to its decarbonization targets, builds 2,100 MW of new gas in the 2026–2027 timeframe. While this does not explicitly represent the Cumberland replacement (or replacements of any other retiring coal facilities) this fossil addition acts as an interesting proxy for TVA's proposal. This scenario, which slows the deployment of clean energy resources in lieu of new gas-fired capacity, results in overall higher economy-wide costs, and delays critical years of new clean energy deployment.

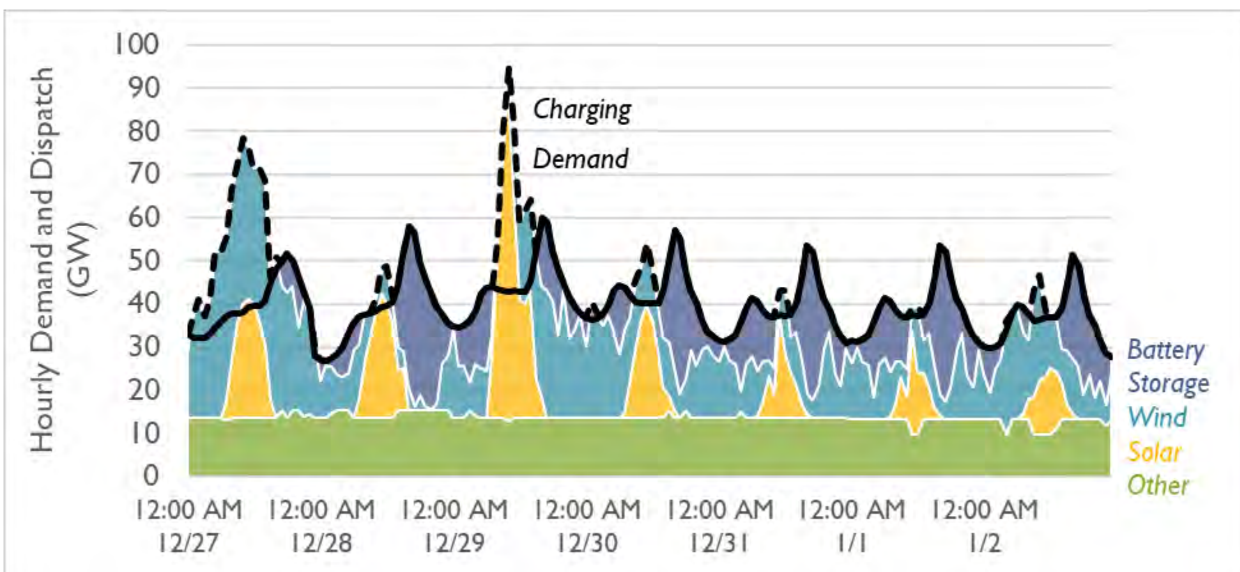
Reliability

For long-term economic planning, Synapse used a capacity expansion modeling approach that condenses each modeled month into a single week and models time in 3-hour slices. This approach accurately models dynamic grid conditions while managing total runtime and computing resource needs. For all modeled capacity expansion runs, modeled portfolios met total load across the entire time period, 2020–2050, with no unserved energy or loss of load events.

To confirm the reliability of the modeled portfolios, Synapse conducted more granular analysis of the performance of modeled scenarios in 2050 over 8,760 hours. While the modeled portfolios met planning reserve margin requirements in all periods, the 2050 supplemental analyses identified a limited number of potential loss-of-load events in the 100% Clean Energy scenario in 0.02 percent of all load-hours. To provide additional resource adequacy, Synapse added an additional 1.5 GW of long-duration energy storage resources, which were sufficient to avoid any unserved energy identified by the supplemental modeling. This report reflects these supplemental storage resources in cost and capacity results throughout. Figure 13 shows hourly dispatch of renewables, energy storage, and other resources in a severe winter week in 2050 with high demand and low renewable generation. Energy storage resources charge during high-renewables periods and discharge to meet load in every hour of the week. Notably, energy storage resources also rely on stored energy accumulated before this week, which is replenished in later weeks with less net load.

Synapse modeling showed that a combination of zero-emissions resources can provide affordable and reliable service, but conventional reserve margin approaches alone might not be well suited to the reliability challenges of the future. Future IRPs should include a comprehensive view of system reliability, including correlated outages, weather patterns, and regional capacity sharing.

Figure 13. Hourly generation by resource, 100% Clean Energy Scenario, December 27, 2050–January 3, 2051



Notes: "Other" includes generation from nuclear, hydro, demand response, and other miscellaneous resources.

System costs

Wholesale electric system revenue requirements for both scenarios remain similar until the late 2030s at about $5 billion. (Costs are higher in the early 2020s due to assumed high gas prices in the near term.)

The TVA Baseline scenario features mostly stable electric system costs. This is despite a shift away from generation sourced from fossil fuels and towards a future that relies on non-emitting sources for almost 100 percent of electricity generation by 2050. After an initial period of high gas prices, costs per MWh remain relatively flat at about $30 per MWh, and gradually decline as more clean energy is added.

In contrast, the 100% Clean Energy scenario features electric system costs that gradually trend upward to about $9 billion per year by 2050, or 73 percent higher than costs in the TVA Baseline scenario. These higher costs are driven by increased electrification, which necessarily requires the construction and operation of new grid resources. Importantly, these increases are *not* born out in cost-per-MWh terms, with this scenario's cost of providing electricity on a per-MWh basis being similar to or even lower than the TVA Baseline scenario. This is not unexpected given the relative similarity of new resource types being added to the grid in both scenarios.

Critically, "revenue requirements" defined here are only inclusive of fuel, variable, and fixed costs, as well as property taxes, book depreciation, allowed return, and other miscellaneous costs. They do not include other costs or savings related to decarbonization, many of which contribute to lower expenditures outside the electricity sector.

Figure 14. Wholesale electric system revenue requirements

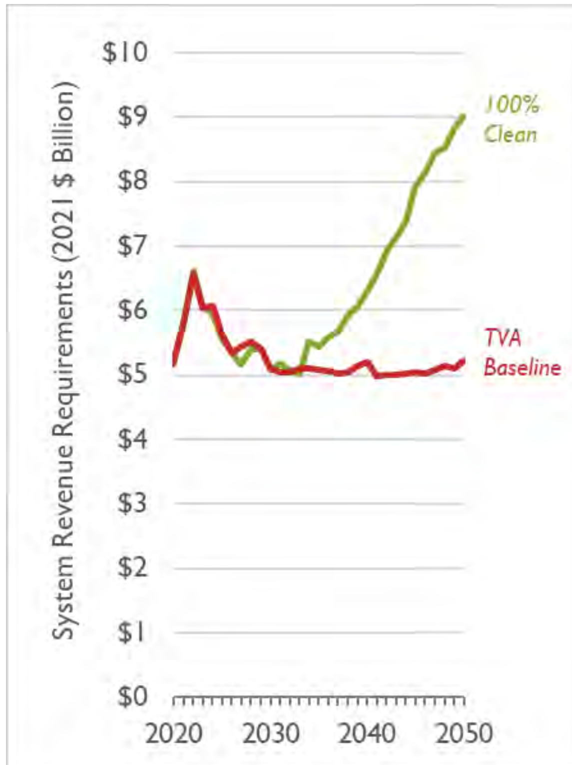
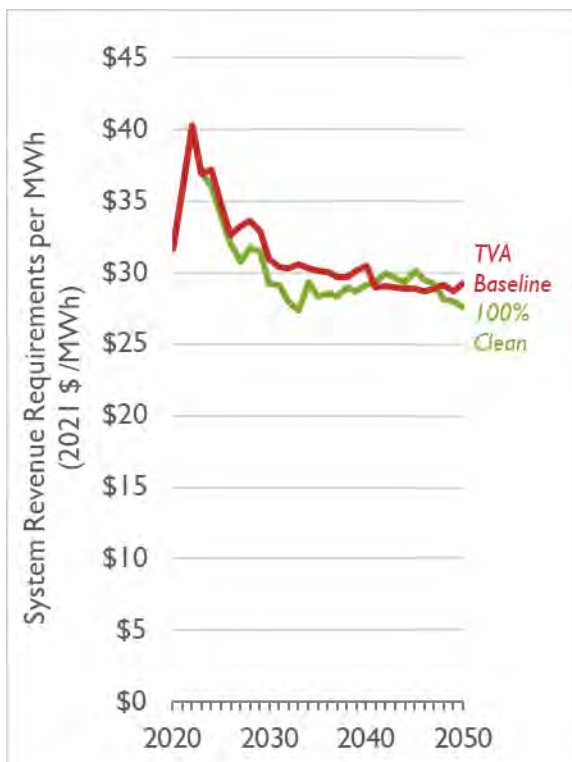


Figure 15. Wholesale electric system revenue requirements per MWh



While electricity system costs are projected to rise in the 100% Clean Energy scenario, these cost increases must be assessed within the context of the wider economy. Table 5 displays the cost differences between the 100% Clean Energy and TVA Baseline cases, with particular focus on 2035, 2050, and all differences accumulating over study period.

Table 5. Single-year and cumulative net costs, 100% Clean Energy versus TVA Baseline (2021 $ billion)

	2035	2050	Cumulative
Electric system	-$1.2	-$4.6	-$53.9
Buildings	$0.0	$0.6	$9.2
Transportation	$8.1	$22.0	$277.2
Other	$0.1	$3.9	$23.0
Net savings	**$7.1**	**$21.8**	**$255.6**

Note: Positive numbers are savings while negative numbers are costs. "Electric system" includes wholesale energy costs, and programmatic and participant spending on energy efficiency and distributed generation resources. "Buildings" includes the costs and savings related to switching residential and commercial to efficient heat pumps and electrifying all remaining end uses, inclusive of avoided fossil fuel expenditures. "Transportation" includes the costs and savings related to consumers switching from conventional internal combustion engine vehicles to EVs, including avoided fossil fuel expenditures, as well as the cost of building out charging infrastructure for EVs. "Other" includes fuel savings related to electrifying the industrial sector but does not include the costs of electrification itself.

We observe that while electric system costs are substantial, these are more than offset by savings from the clean energy transition outside the electric sector. For example, non-electric fuel savings tally almost $240 billion over the study period. These savings are over seven times larger than the additional costs resulting from ambitious electrification and clean energy deployment. These non-electric fuel savings are largely related to a reduced reliance on fossil fuels for heating and transportation, with lower motor gasoline and diesel demand driving about 80 percent of these savings.

Other aspects of the clean energy transition impose their own costs or produce their own rewards. For example:

- An increased reliance on demand-side resources, including energy efficiency and distributed generation, adds about $21 billion in cumulative costs.[23] However, these resources avoid increased reliance on utility-scale resources, playing a critical role in decreasing land-use impacts and diversifying TVA's resource portfolio.
- Outside of motor gasoline and diesel savings, the switch to EVs is projected to save $82 billion cumulatively. This is because, while EVs are assumed to be more expensive than internal combustion engine (ICE) vehicles initially (not including tax credits), starting in about 2035 EVs are assumed to be lower in upfront cost. Most EVs are deployed after 2035, leading to decreased costs overall. In addition, throughout the study period, EVs are assumed to have lower operating and maintenance costs than ICE vehicles, producing further savings. Finally, we assumed that almost 470,000 EV chargers are

[23] This is inclusive of both participant and programmatic costs for both energy efficiency and distributed generation.

built by 2050 to accommodate the millions of new EVs in TVA's service territory. Using the National Renewable Energy Laboratory's (NREL) EVI-Pro Lite model, we estimated the cost of these chargers to be about $3.4 billion, cumulatively. However, these costs are more than offset by cheaper vehicles and lower operating and maintenance costs, leading to lower motor vehicle costs overall.

- We estimated that building electrification poses a small increase in costs, largely due to heat pumps being assumed to be more expensive than conventional HVAC equipment. This takes into consideration tax credits for heat pumps through the early 2030s as a result of the IRA but assumes that these tax credits disappear and that heat pump equipment remains more expensive than conventional HVAC equipment throughout the remainder of the study period.

When all of these factors are taken into account, the electric system costs of a clean energy transition are dwarfed by the potential economy-wide savings. TVA's service territory stands to save over $255 billion over the study period if it were to follow a trajectory like that shown in the 100% Clean Energy scenario. While our net cost calculation did not account for other transition costs such as the cost of new transmission or distribution within TVA and the cost (and savings) of industrial electrification, these unaccounted-for costs would need to exceed $255 billion in order for the 100% Clean Energy scenario to be uneconomic.

Finally, the net savings shown here do not include savings due to improved public health or savings associated with the social cost of carbon (see page 30).

Rate impacts, bill impacts, and energy burden

In a clean energy future, electricity customers will likely experience a change in electricity rates and bills due to several factors:

- Many customers will consume more electricity as they shift away from fossil fuels for heating or transportation purposes, and increasingly rely on electricity for all energy purposes. This increase in electricity consumption may be lessened by the presence of energy efficiency measures or more efficient electric appliances.

- Both clean energy requirements and increased electricity demand due to electrification will contribute to an increased buildout of clean energy resources. This will increase the cost of running the electricity system relative to a scenario where no such resources are needed due to flat electricity consumption). However, increased consumption of electricity does not necessarily mean customers' electricity rates will increase in tandem. Electricity rates even have the potential to decrease if electrification results in a switch to less expensive resources or better utilization of electricity infrastructure.

- It will be important for TVA and local power companies to closely evaluate the drivers of these costs and allocate the costs accordingly in order to avoid cost-shifting among customers.

For this study, we evaluated the increase in system costs (relative to today) in each scenario. We then allocated the increase in costs to the residential, commercial, and industrial sectors in line with each sectors' increase in electricity consumption. In the 100% Clean Energy scenario, we observe that residential and commercial customers experience an increase in electricity consumption of about 60 percent per customer, whereas industrial customers experience an increase in electricity consumption of about 175 percent per customer.[24] Importantly, the cost of increases in electricity consumption are offset by decreases in the end-use consumption of fossil fuels, and all costs related to this (see Table 5, above).

As a result of costs and usage increasing at nearly the same rate, we observe that overall electricity rates remain relatively consistent across time and between the two scenarios. Table 6 demonstrates the modeled electricity rates in 2020, 2035, and 2050. On a simplified, dollar-per-kWh basis, we observe that electricity rates in the 100% Clean Energy scenario either remain flat or slightly decrease over time. We note that this is in line with TVA's priority to reduce electricity rates.

Table 6. Modeled electricity rates, bills, and energy burden

	2020	2035		2050	
	Actual	*TVA Baseline*	*100% Clean Energy*	*TVA Baseline*	*100% Clean Energy*
Electricity rates (2021 cents/kWh)					
Residential	11.4	10.7	9.0	9.7	8.0
Commercial	10.9	10.6	9.8	10.4	7.7
Industrial	4.4	4.3	4.4	4.2	3.3
Monthly electric bill (2021 $/customer)					
Residential	$131	$131	$141	$129	$149
Energy burden (% of household income)					
Residential	7%	7%	5%	6%	3%

Notes: "Actual" electricity rates for 2020 are based on data reported to EIA Form 861 (available at https://www.eia.gov/electricity/data/eia861/) for TVA and all local power companies in TVA's service territory. For the purposes of this analysis, rates are analyzed in a highly simplified way—in reality, rates and rate structures for customers across TVA's service territory may differ widely, with some customers utilizing rates that include fixed costs, demand costs, or other more complex rate approaches.

However, Table 6 shows that for residential customers, 2050 monthly bills in the 100% Clean Energy scenario increase by 13 percent.[25] Although the electricity system is used more efficiently, and costs are allocated according to increases in electricity consumption, an overall increase in electricity consumption leads to increased bills.

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[24] In this analysis, we assumed that residential and commercial customer counts also increase at the same pace as electrification. We assumed that the number of industrial customers remains constant.

[25] Rate increases for residential customers could be tempered by local power companies deploying rate structures that align consumption with grid needs (e.g., time-of-use rates). Electricity bills are not calculated for customers in the commercial and industrial sectors due to the fact that electricity consumption by customers in these sectors can differ substantially.

Critically, electricity bills are just one part of the equation. At the same time, as residential customers begin to pay more for their higher electricity consumption, they also reduce their spending on fossil fuels. Avoiding spending on inefficient fossil fuels for home heating, water heating, and transportation leads to an overall reduction in household energy costs. Energy burden is a common metric used to assess how much typical households spend on their energy costs as a share of their household income. Per U.S. Census' American Community Survey (ACS), the typical household in TVA's service territory has a median income of about $56,100 per year.[26] If we assume this median household income remains unchanged through 2050, Table 6 shows that energy burdens decrease over time in the 100% Clean Energy scenario, from about 7 percent today to merely 3 percent in 2050.[27] This halving in energy burden is in large part due to a switch away from inefficient spending on fossil fuels, including motor gasoline. Furthermore, a reduction on fossil fuel use (and associated spending) will lead to more money staying in the Tennessee Valley rather than going to companies involved in fossil fuel extraction outside the Valley. We quantify these impacts, as well as other job impacts, in the following section.

Job impacts

A transition to clean energy is poised to create thousands of jobs in the Tennessee Valley, echoing one of the original purposes of TVA. Using data from the IMPLAN model, we estimated the annual impacts on jobs resulting from the 100% Clean Energy scenario, relative to the TVA Baseline scenario.[28] Figure 16 shows that over the study period, TVA's service territory stands to gain an average of 15,600 full-time-equivalent (FTE) jobs in each year. Job impact estimates include those related to initial construction; ongoing fueling, operation, and maintenance (O&M); and respending.

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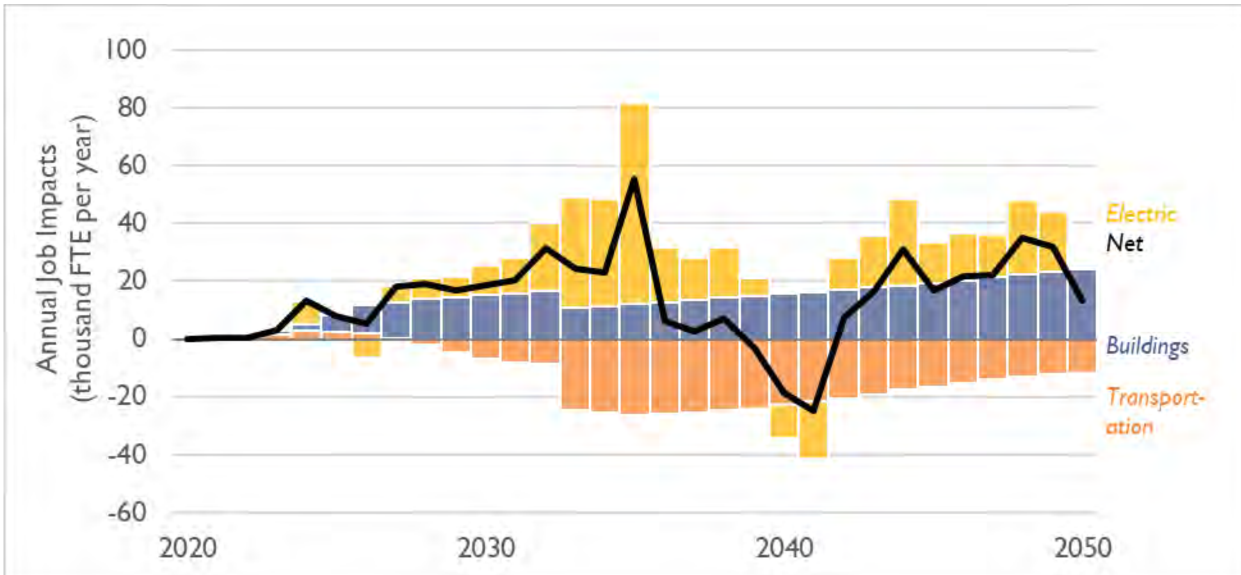
[26] County-level household income data from the 2020 5-Year ACS estimate is available at https://data.census.gov/cedsci/table?t=Income%20%28Households,%20Families,%20Individuals%29&g=0100000US%240500000&tid=ACSST5Y2020.S2503.

[27] This calculation of energy burden is inclusive of electricity expenditures, fossil fuel expenditures, and energy efficiency and distributed generation participation costs. Per energy burden convention, it is not inclusive of expenditures on new end-use equipment, such as new (or avoided) HVAC equipment or vehicles.

[28] For more information on the IMPLAN model, see https://implan.com/.

Figure 16. Job impacts from the 100% Clean Energy scenario, relative to the TVA Baseline scenario



We calculated job impacts based on two primary inputs: the amount of money spent on a particular activity in a given year, and the jobs associated with spending money on that activity (a "job factor"). Each modeled sector sees different drivers for job impacts. In the electric sector, we projected an additional 14,700 full-time positions on average in each year. Large increases in employment in individual years are linked to in-region construction of solar, battery storage, and energy efficiency resources, as well as transmission construction needed to facilitate out-of-region wind purchases.[29] The IRA also plays a role in lowering the cost of many renewable resources, thereby creating jobs at a higher rate per million dollars spent by TVA residents. Still, a small number of jobs are lost due to a transition away from fossil fuels—these jobs are few in number, in part because modern gas plants employ relatively few people, and because large, older coal plants are assumed to retire in both scenarios. Jobs also decrease as a result of increased spending—consumers are likely to spend more money on electricity in a clean energy future (and less on other fuels), reducing their opportunities to use that money for other purposes and stimulate job growth. These job decreases are included in the "Electric" component of Figure 16.

In the buildings sector, we observe an additional 15,800 job-years per year. This is because we assumed that heat pumps are more labor-intensive to install than conventional HVAC systems (in other words, for every $1,000 spent on a heating system, more of that money will go to on-site labor for a heat pump installation, relative to a conventional fossil-fuel-powered furnace). Our calculations account for the total cost of a heat pump installation. For example, our employment results reflect the increased labor associated with installing higher capacity electric panels for houses that transition to electric heating. Avoided fuels are also a large job generator—every dollar not spent on purchasing natural gas or other

[29] Several years that appear to have zero or negative job additions under the electric sector are due to the TVA Baseline scenario having similar or slightly larger job additions than the 100% Clean Energy scenario.

fossil fuels for heating means more money in the pockets of consumers, who then stimulate job growth with increased spending in the wider economy.

The transportation sector is the only sector where our analysis found consistent job losses. This is due to two reasons: first, EVs require fewer expenditures on maintenance and operation compared to conventional gasoline- and diesel-powered vehicles, leading to a decrease in jobs. Second, relying on the latest data from Argonne National Laboratory, we estimated that the typical EV will be cheaper than the typical ICE vehicle starting around 2030 (not accounting the impacts of tax credits in the IRA).[30] Most EVs sold in the study period are sold after this date, leading to an overall reduction in the amount of money spent on new vehicles in the 100% Clean Energy scenario. This reduced spending on vehicles, combined with an assumption that a greater share of EV parts are made outside of TVA than are conventional vehicle parts, leads to an overall reduction in transportation-sector jobs. This is in spite of reduced spending on motor gasoline and diesel, which results in more money for consumers. As with the buildings sector, much of this money is then re-spent in the wider economy, creating new jobs. This trend is amplified by tax credits available under the IRA, which are assumed to put more money in consumers' pockets through 2032.

According to data from the Bureau of Labor Statistics, TVA's service territory has about 4.7 million jobs.[31] An increase in full-time employment of 15,600 positions represents an increase of about 0.3 percent.

Caveats to job impacts

The above job impacts are predicated on an assumed methodology and set of inputs.

- All job factors used in this analysis are static snapshots of Tennessee's economy as it existed in the recent past.[32] These may change in the future, with corresponding impacts on jobs. For example, should Tennessee and other parts of the Tennessee Valley become hubs of EV manufacturing (as is planned by TVA and others, for example), net impacts to jobs could be even more positive than are currently calculated.[33]

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[30] Burnham, A. et al. *Comprehensive Total Cost of Ownership Quantification for Vehicles with Different Size Classes and Powertrains*. Argonne National Laboratory. April 2021. Available at https://publications.anl.gov/anlpubs/2021/05/167399.pdf.

[31] U.S. Bureau of Labor Statistics. *Local Area Unemployment Statistics*. Accessed December 2022. Available at https://data.bls.gov/timeseries/LASST470000000000005?amp%253bdata_tool=XGtable&output_view=data&include_graphs=true.

[32] IMPLAN is typically run for individual states. For this analysis, we assume that job factors in Tennessee are representative of job factors in the wider TVA service territory.

[33] "Ford aims to create 5,700 jobs with new factory, battery plant near Memphis" *The Tennessean*. September 27, 2021. Available at https://www.tennessean.com/story/money/business/development/2021/09/27/ford-electric-vehicles-memphis-regional-megasite-new-jobs/5884664001/; "TVA Accelerates Nation's Decarbonization Efforts, Fuels a Clean Energy Economy." Press Release. TVA. May 11, 2022. Available at https://www.tva.com/newsroom/press-releases/tva-accelerates-nation-s-decarbonization-efforts-fuels-a-clean-energy-economy.

- Our analysis included calculations of direct, indirect, and induced jobs. In other words, our analysis included job impacts at the resources or facilities themselves, upstream impacts related to development of components for the resources or facilities, and other ripple effects in the economy related to respending energy bill savings and other effects.
- Our analysis focused on impacts in TVA's service territory only. It did not account for positive or negative impacts that accrue outside of TVA. For example, construction jobs associated with building out-of-region wind that provides electricity to TVA were not included.
- Our analysis did not account for industrial job impacts due to a lack of available cost information and job vectors. Because this activity is likely to require a large amount of local capital investment, we expect that it would produce net positive jobs.

Other impacts

A transition to clean energy in TVA's service territory has many other benefits beyond the purely economic. This section describes benefits related to public health, social cost of carbon, water use, and coal ash. This section also includes a discussion of potential land-use impacts related to a clean energy transition.

Public health and social cost of greenhouse gases

Burning fossil fuels produces hazardous air pollution. The combustion of fossil fuels (including coal, gas, gasoline, diesel, among others) and biomass results in the formation of pollutants like SO_2, NO_X, PM, VOCs, and NH_3. These pollutants are released into the atmosphere from a power plant's smokestack, a car's tailpipe, or a home or business' chimney. These pollutants may then be dispersed over a wide area, or stay locally. Eventually, they may find their way into a person's respiratory system where they may cause health impacts related to asthma, heart conditions, or even premature death.

Using the COBRA created by U.S. Environmental Protection Agency, we calculated the health impacts of phasing out fossil fuels in the 100% Clean Energy scenario, relative to the TVA Baseline scenario.[34] Table 7 summarizes these results. We see that over the entire study period, phasing out fossil fuels leads to over $27 billion in public health benefits realized nationwide. About 90 percent of benefits are due to reductions in criteria air pollutants outside the electric sector (e.g., from cleaner cars, buildings, and industry). Within the electric sector, both the 100% Clean Energy and TVA Baseline scenarios are very similar in terms of criteria pollutant emissions—both feature coal retirements that occur on about the same schedule, and both scenarios reach zero emissions at some point in the study period. In other words, even without substantial electrification, by switching to clean energy TVA can reduce its impact on the health of those living in its service territory. But by planning for a high electrification future, these public health benefits stand to be much greater.

[34] More information on COBRA can be found at https://www.epa.gov/cobra.

Table 7. Public health benefits related to phasing out fossil fuels

	2035	2050	Cumulative (2020–2050)
Benefits (2021 $ B)	$0.6	$2.4	$26.6

Next, Table 8 summarizes the benefits related to the social cost of carbon. The social cost of greenhouse gas is a "damages" calculation that describes the amount of harm avoided from reducing the emissions of greenhouse gases, as these gases contribute to catastrophic climate change. We found that over the study period an accelerated clean energy future avoids over $265 billion in damages related to greenhouse gas emissions.

Table 8. Social cost of greenhouse gas benefits related to phasing out fossil fuels

	2035	2050	Cumulative (2020–2050)
Benefits (2021 $ B)	$9.8	$21.1	$265.2

Water use

As a result of fossil plant retirements, water use in TVA's service territory drops by about one-third. In particular, water withdrawals fall from about 3.2 trillion gallons in 2020 to about 2 trillion gallons in the early 2030s, when the last coal plants retire.[35] Water withdrawals hold at about 2 trillion gallons through 2050, as a result of nuclear plant operation. Meanwhile, water consumption (i.e., water that is withdrawn and not returned to the water source) falls by about one-half: after fossil and coal generation cease in 2035, we estimate an ongoing annual water consumption of about 11 billion gallons from the nuclear plants in every year from 2035 to 2050.

Coal ash

According to data from EIA, almost 90 percent of ash produced in TVA's service territory comes from just two coal plants: Cumberland and Red Hills Generating Station (a plant located in Choctaw County, Mississippi, with which TVA has a PPA). About 80 percent of this coal ash is used for productive purposes; the plants dispose of the other 20 percent. The modeling assumed that Cumberland retires in 2026 and the Red Hills PPA ends in 2031. As a result, by 2032, coal ash production for all of TVA's service territory falls by 90 percent, relative to today. Some ash production continues (at rate of about 9 thousand tons per year) from biomass facilities until these plants retire. By 2035, the requirement for TVA to procure electricity only from non-emitting facilities causes the production of coal ash to cease entirely.

[35] We note that there are some differences in the reported historical values for water use and coal ash in this report, relative to the historical values reported in the 2019 TVA IRP. All values reported in this analysis are based on publicly available data from EIA. Values in the 2019 TVA IRP may include water use and coal ash data for some plants that do not have data reported to EIA.

Land use

TVA's service territory encompasses an area of roughly 60 million acres, of which 293,000 acres are directly managed by TVA.[36] This does not include additional land area that currently hosts TVA's fossil-fired and nuclear power plants. In the 100% Clean Energy scenario, we estimated an increase in the demand for land needed to host the required solar, wind, and storage generating plants. Table 9 describes the distribution of capacity for the scenario, by resource type and region.

Table 9. Geographical distribution of renewable capacity, 100% Clean Energy scenario

	2035	2050
Wind	**14.0**	**41.2**
In TVA	*1.8*	*2.3*
Outside TVA	*12.2*	*38.9*
Solar	**35.0**	**101.0**
In TVA, distributed	*2.4*	*4.4*
In TVA, utility-scale	*32.6*	*96.6*
Outside TVA, utility-scale	*0.0*	*0.0*

Figure 17 compares the size of TVA's service territory to that of a number of existing land uses, alongside the land-use requirements of in-Valley resources, in a clean energy future.[37] We note the following:

- In-region wind land use is very small, relative to TVA's service territory.[38] This is due to the fact that the 100% Clean Energy scenario estimates only a small amount of in-region wind to be cost-effective, coupled with the fact that wind turbines need only impact a small amount of land immediately around the turbine footprint. The remainder of the land under the span of the turbine blades (and between turbines) can remain productive for other uses, such as livestock raising or agricultural. Land impacts associated with out-of-region wind are not shown. These would likely be 17 times larger than those shown for in-region wind but would be located in areas of the Midwest that already have a long history of installing wind turbines alongside existing agricultural uses.

[36] More information on TVA's managed area is available at https://www.tva.com/environment/environmental-stewardship/land-management/reservoir-land-management-plans.

[37] The design of this figure was inspired by Figure 30 in Denholm, Paul, Patrick Brown, Wesley Cole, et al. 2022. *Examining Supply-Side Options to Achieve100% Clean Electricity by 2035*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A40-81644. https://www.nrel.gov/docs/fy22osti/81644.pdf

[38] Land-use requirements for onshore wind are based on *Land-Use Requirements of Modern Wind Power Plants in the United States*. National Renewable Energy Laboratory. 2009. Available at https://www.nrel.gov/docs/fy09osti/45834.pdf, with an assumed factor of with an assumed factor of 333 MW_{AC} buildable per acre. This value includes direct land use impacts only (e.g., from turbine pylons and access roads).

- At 4 GW in 2050, distributed solar is projected to occupy just 4 percent of the estimated residential, commercial, and industrial rooftops available in TVA's service territory.[39] In other words, if only 4 percent of the rooftops in TVA's service territory were the site of future solar installations that would be enough to accommodate the distributed solar assumed in the 100% Clean Energy scenario. In the Ambitious DER scenario (described more below on page 37) an increased level of distributed solar (6 GW) would occupy 6 percent of rooftops.

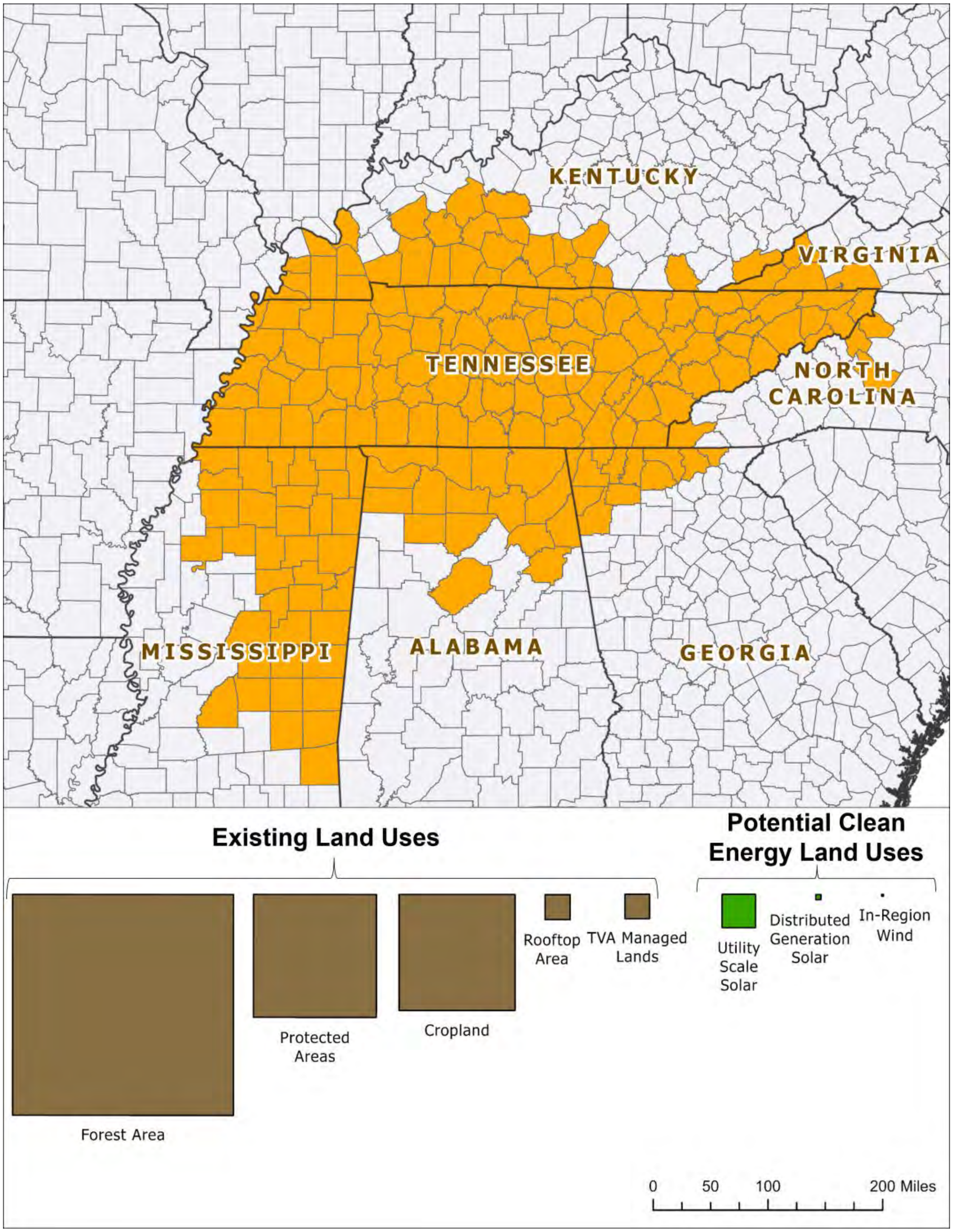
- The land requirements for utility-scale solar are the largest future land use associated with clean energy production, with about 540,000 acres being needed for utility-scale solar in 2050 in the 100% Clean Energy scenario, or about 1 percent of the entire service territory area of TVA.[40] If the 540,000 acres of utility-scale solar were allocated equally across the almost 200 counties served by TVA, each county would require 2,700 acres dedicated to solar (or about 1 percent of each county). This would also translate to about 480 MW built in each county, about 18 MW built in each county in each year from 2024 to 2050, or about two projects on the scale of the Muscle Shoals solar project in Muscle Shoals, AL built in each county over the study period. This land area impact could be mitigated by shifting a greater share of this to rooftop solar, or by prioritizing landfills, brownfields, or other locations of less-than-prime agriculture or biological diversity value. TVA could also study the areas in its service territory that are likely to harbor lower quantities of embedded CO_2 in forests and other biomes, in order to prioritize the types of land most suitable for future solar development.

- Land-use impacts for battery storage are not shown. Siting storage tends to be less controversial than solar, wind, or conventional resources because of the relatively low impact these facilities have on their surroundings (i.e., in terms of environment or aesthetics) and the less stringent siting requirements for these facilities compared to other resources (i.e., they need not occupy one large area or be located in an area with particular physical characteristics (e.g., locations that are particularly sunny or windy).

[39] Land-use requirements for distributed solar are based on *Rooftop Solar Photovoltaic Technical Potential in the United States*. National Renewable Energy Laboratory. 2016. Available at https://www.nrel.gov/docs/fy16osti/65298.pdf, with an assumed factor of with an assumed factor of 85 MW_{AC} buildable per acre.

[40] Land-use requirements for utility-scale solar are based on M. Bolinger and G. Bolinger, "Land Requirements for Utility-Scale PV: An Empirical Update on Power and Energy Density," in *IEEE Journal of Photovoltaics*, vol. 12, no. 2, pp. 589-594, March 2022, doi: 10.1109/JPHOTOV.2021.3136805. See Figure 3 and Section IV, with an assumed factor of 69 MW_{AC} buildable per acre.

Figure 17. Map of land-use requirements in the 100% Clean Energy scenario, compared with land-use requirements for existing uses



Note: Counties in yellow are counties where at least some electricity is supplied by TVA.

3. Recommendations for Future Modeling Efforts

The 100% Clean Energy scenario modeled in this analysis is just one possible future of many. Historically, TVA's planning has not encompassed futures that are consistent with its newly stated clean energy and carbon-reduction aspirations. As this analysis shows, the transition to a clean energy future poses some challenges and results in an electric system that is very different than TVA's current system. But the benefits of such a transition stand large, indicating that TVA should make the effort to investigate this transition in its forthcoming modeling processes.

This chapter includes a sampling of questions that stakeholders may wish to ask about TVA's future modeling efforts, as well as an overview of the important issues related to clean energy planning that TVA and others should consider in these future modeling efforts.

3.1. TVA should consider its decarbonization targets in resource planning

First, any future modeling efforts by TVA should at least be inclusive of TVA's own goal of reducing greenhouse gas emissions by 70 percent by 2030, 80 percent by 2035, and reaching net zero carbon emissions by 2050.[41] These targets are in alignment with science-based goals aimed at averting the impacts of catastrophic climate change and current federal policy as set forth in the Biden Administration's executive orders. TVA planning should account for the fact that some options available to it today are at odds with its medium- and long-term goals. Building fossil plants have expected operating lifetimes of more than 25 years (such as the proposed 1,450-MW gas place replacement for the Cumberland coal plant) in the mid-2020s may preclude achievement of TVA's midcentury emission goals. As our analysis showed, even more ambitious levels of carbon reductions are possible, and with net benefits to consumers in TVA's service territory.

3.2. TVA should increase cost-effective energy efficiency investments

TVA has historically planned for only a very small amount of energy efficiency. This analysis considered a future where TVA looks to neighboring states and increases the level of energy efficiency deployed. TVA has historically been resistant to plan for increased levels of energy efficiency, with its consultants citing issues related to costs and potential pertaining to states that have been leading the charge on energy efficiency for years, rather than a region such as TVA that is still only in the nascent stages of energy efficiency deployment.[42]

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[41] For more information on TVA's climate goals, see its "Carbon Report" web page, available at https://www.tva.com/environment/environmental-stewardship/sustainability/carbon-report.

[42] Concentric Energy Advisors. *Assessment of the Draft Environmental Impact Study and Response to Certain Reports*. 2022. Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-

3.3. TVA must consider electrification trends and the IRA to prepare for economy-wide decarbonization and increased demand

TVA's past modeling effort in its 2019 IRP contemplated very low levels of electrification. Next time, TVA should consider more ambitious levels of transportation and building electrification that at least reflect the adoption likely to occur with the incentives proscribed in the IRA. These include a $7,500 personal tax credit for many light-duty vehicles consumers are likely to buy, tax credits for medium- and heavy-duty vehicles that range from $7,500 to $40,000, tax credits for charging infrastructure, and tax credits for installing efficient heat pump equipment. These tax credits are likely to accelerate the current market trends that even without the IRA point to a much more ambitious level of electrification than assumed by TVA in past modeling.

In addition to modeling the likely effects of the IRA, TVA should model levels of electrification in the non-electric sectors that are consistent with its own carbon reduction goals for the electric sector. In other words, it would be most realistic for TVA to assume a zero-carbon emissions future in the electric sector happens alongside a future in which other sectors of the Tennessee Valley decarbonize (and are likely electrified).

Future electrification analyses should also examine the load shapes likely to result from this new electrification. For example, our analysis found that, on an annual basis, full electrification of the Tennessee Valley's residential and commercial sectors through efficient heat pumps is likely to produce net energy *savings* compared to a business-as-usual alternative. In other words, TVA could rely on deployment of heat pumps as an energy efficiency measure that reduces reliance on electric resistance heating, making winter peaks easier to manage.[43] This approach would yield near-term benefits, in addition to longer-term benefits related to emission reductions and associated impacts. Likewise, future modeling efforts should contemplate a range of load shapes related to vehicle electrification. As explored in the section below titled *Takeaways from the Ambitious DER scenario*, flexible loads can help to reduce electricity demand during periods of grid stress. Future technologies, such as vehicle-to-grid integration, may even go a step further by allowing EVs to act as mobile batteries that provide additional grid resources on the parts of the grid where they are most needed.

Finally, given the relatively large size of industrial energy consumption (and associated emissions) in the Tennessee Valley, we recommend that more work be done to better understand the likely trajectory that electrification might take for this sector. In this analysis, we utilized a set of assumptions that envision relatively rapid electrification to better understand impacts on the electric grid. We recommend that future modeling efforts take a closer look at individual industries or facilities and

source/environment/cumberland-fossil-plant-retirement-final-eis4eeac6f0-b6bf-4843-9881-75d19ccf8ede.pdf?sfvrsn=d61f6b6f_7.

[43] We note that future TVA analyses of electrification impacts could rely on NREL's ResStock and ComStock models (see https://www.nrel.gov/buildings/resstock.html and https://www.nrel.gov/buildings/comstock.html), which can provide even more granular data on county-level energy use.

develop a finer-grained plan of how these industries might pursue electrification, and what the associated impacts and costs are likely to be.

3.4. TVA planning processes should evaluate demand-side resources as options to mitigate grid investment and reduce total system costs

TVA's 2019 IRP envisions several different trajectories for distributed storage and solar. We recognize that the distributed solar trajectory described by TVA as "moderate" (which was used in the 100% Clean Energy scenario) is rather ambitious: 1.7 GW by 2030, and projected out to 4.4 GW by 2050 by Synapse. On the other hand, TVA could model the assumed distributed storage trajectories more realistically: the trajectory described by TVA as "moderate" (and assumed in the 100% Clean Energy scenario) has 25 MW by 2030, which has been projected out to 270 MW by 2050 by Synapse. A 2022 NREL study observes that in 2020, 960 MW of behind-the-meter storage was installed nationwide, and that this number was projected to be about 7,300 MW by 2025.[44] If 1 percent of this were installed in TVA's service territory (about equal to the TVA service territory's fraction of the nation's population) this implies 73 MW by 2025, or the level of behind-the-meter storage that TVA does not project existing until 2036. We recommend that TVA continue to review the literature on these quickly advancing technologies and model appropriate levels of distributed solar and storage in future efforts.

Takeaways from the Ambitious DER scenario

In addition to the 100% Clean Energy scenario, we modeled an "Ambitious DER" scenario to understand the possible future benefits of increased emphasis on demand-side resources. The inputs to this scenario closely resembled those used in the 100% Clean Energy scenario, with two primary differences:[45]

- **More distributed solar and distributed storage:** This scenario follows the "High" case described in TVA's 2019 IRP, rather than the "Medium" case assumed in the 100% Clean Energy scenario. This leads to an additional 1.9 GW of distributed solar and an additional 0.8 GW of distributed storage by 2050.
- **Inclusion of "flexible load" resources:** This scenario contemplates a future where newly electrified end uses are capable of flexible load-shifting. In other words, we assumed that some fraction of new end uses are able to defer load for some number of hours until it is more economically efficient for that load to be served by available generation.

[44] Cook, Jeffrey J., Kaifeng Xu, Sushmita Jena, Minahil Sana Qasim, and Jenna Harmon. 2022. *Check the Storage Stack: Comparing Behind-the-Meter Energy Storage State Policy Stacks in the United States*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20-83045. https://www.nrel.gov/docs/fy22osti/83045.pdf.

[45] For more detail about the assumptions used in these scenarios, see Table 3 on page 13.

The increased levels of storage and distributed storage lead to reduced levels of utility-scale versions of the same resources. But it is the inclusion of the flexible load resources that leads to the largest differences in results.

In our analysis, we assumed flexible load potential and parameters using a 2020 study from NREL.[46] Using this study, we estimated the share of newly electrified end uses that could have flexible load attributes. Specifically, we assumed that about half of the modeled flexible load is associated with EV charging, where load can be shifted by up to eight hours. One-third of the flexible load is associated with space heating and cooling, where load can be shifted by up to 1 hour. The remaining flexible load associated with transportation, industrial end uses, and non-space heating and cooling end uses in residential and commercial buildings is shiftable by between 1 and 8 hours. This scenario assumes the dispatch costs of this resource is $0/MWh, and that there are no incremental capital costs associated with implementing this flexible load. We assumed that all flexible load has only a 50 percent capacity contribution. This means that while there is 32 GW of flexible load available to be dispatched at any one time, only 16 GW may contribute to the capacity requirement. Finally, we assumed that this flexible load resource phases on over the study period consistent with the deployment of newly electrified end uses.

With these parameters, we found that flexible load acts as nearly a one-to-one replacement for the energy service from batteries, and a two-for-one replacement for the capacity contribution that batteries otherwise supply. In other words, we found that the model replaces about 16 GW of 8-hour battery storage that it otherwise builds in the 100% Clean Energy scenario. By 2050, this flexible load resource dispatches about 45 TWh, enabling the model to shift energy from periods when excess generation is occurring to periods when load is higher and generation is lower. We observed electric system savings of about $1.5 billion in 2050, relative to the 100% Clean Energy scenario. This implies dispatch payments on the order of about $30 per MWh or about $50 per kW-year. In this analysis, we decided not to assign a dispatch cost to the flexible load resource. However, in a future electric system that is highly responsive to load, grid operators would likely pay demand-side users to shift or otherwise reduce load at certain hours. Our analysis suggests that the flexible load resources reduce a substantial amount of battery storage that would otherwise be necessary to meet reliability. These savings, when translated into per-MWh figures, suggest that the "cost" of flexible load dispatch is close to $30/MWh. Further detailed analysis is required to evaluate the potential of this resource in the Tennessee Valley and the effective dispatch cost.

We recommend that TVA consider the impact of flexible load resources such as the ones described above in future modeling endeavors, as they appear to be able to substantially decrease capital-intensive resource construction and associated cost and supply chain impacts.

[46] Sun, Y. et al. Electrification Futures Study: Methodological Approaches for Assessing Long-Term Power System Impacts of End-Use Electrification. National Renewable Energy Laboratory (NREL). 2020. Available at https://www.nrel.gov/docs/fy20osti/73336.pdf.

3.5. TVA should evaluate renewables and conventional resources on equal footing

Any future modeling of the TVA service territory should place clean energy resources on equal footing with conventional resources. This includes using the latest, up-to-date information on current renewable energy costs as well as projections of future energy costs, such as those in industry-standard analyses like the *Annual Technology Baseline* published by NREL. TVA should modify these costs as necessary to reflect recent developments, such as newly passed tax credits or impacts to a resource's supply chain. TVA should apply these same considerations equally to both clean energy resources and conventional resources—for example, analyses should account for the latest data on fuel price projections and supply chain issues, some of which may lead to higher costs for these resources. These analyses should also consider realistic firm capacity contributions from existing and new fossil plants—if conventional fossil fuel plants do not have firm fuel sources, or have proven to be unreliable during recent extreme weather events, their firm capacity contributions should be decreased accordingly.

Our analysis found that when using the latest information on resource costs, inclusive of IRA impacts, the least-cost approach is invariably a switch from conventional fossil-fired resources to a future more dependent on solar, wind, and storage—even without a carbon emissions reduction requirement. This deployment is not without its challenges: our 100% Clean Energy scenario would require $45 billion of new capital investment on new inter-regional transmission lines in order to facilitate 39 GW of low-cost, high-capacity factor wind in TVA's neighboring territories.[47] However, even with these added costs, our modeling identified increased investment in these resources as key to a low-cost future for TVA.

Future modeling should also contemplate greater interconnection between TVA and neighboring regions. Prior TVA analyses have included resources in these regions, but with out-of-date information on current costs and tax credits, as well as unrealistic assumptions lacking future cost declines. Our analysis finds that when these resources are modeled with up-to-date cost information, our model seeks to build out-of-region wind resources, analyzing the high-capacity factor, low-cost, zero-emissions wind to be a perfect complement to in-region solar and storage resources. In its future modeling efforts, TVA would be well-served to look at other potential benefits of greater regional interaction among TVA and its neighboring balancing authorities. Higher levels of regional integration could help address issues related to resource curtailments or capacity shortfalls due to weather issues. We found that in the 100% Clean Energy scenario, curtailments in 2050 total almost 100 TWh, or about one-fifth of all generation. This level of curtailment is consistent with those observed in other deep decarbonization projections but could be lessened through greater regional integration or an increased reliance on flexible load resources (see section above titled *Takeaways from the Ambitious DER scenario*).

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[47] All assumptions related to inter-regional transmission line costs are based on data from Denholm, Paul, Patrick Brown, Wesley Cole, et al. 2022. *Examining Supply-Side Options to Achieve100% Clean Electricity by 2035*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A40-81644. https://www.nrel.gov/docs/fy22osti/81644.pdf. We note that the level of transmission build modeled between TVA and neighboring regions in our analysis resembles the level of transmission build modeled in this NREL analysis. All transmission lines are assumed to be 500 kv AC.

Enhancing these interconnections has additional reliability benefits. During Winter Storm Elliot in December 2022, the neighboring MISO region scheduled more than 1 GW of electricity imports for a multi-day period.[48]

3.6. TVA should improve reserve margin modeling and appropriately evaluate the reliability contributions of renewables

TVA currently relies on a firm capacity construct that uses different seasonal values for summer and winter, and assumes that each resource type contributes a static portion of its capacity in each seasonal period. In our analysis, we observed that a switch to increased levels of low-cost, zero-emissions wind, solar, and storage render the current resource adequacy framing irrelevant. Rather than facing constraints at single high-demand hours, future reliability issues are likely to develop over the course of several days, when the grid is facing periods of high demand but relatively lower levels of renewable generation. As a result, future reserve margin and firm capacity requirements will likely need to be revised or overhauled entirely to reflect this new changing paradigm. For the purposes of this report, we continued to assume TVA's current approach to reserve margins and firm capacity, although we recommend that future analyses evaluate other strategies.

As described above in the *Reliability* section of *2.3 Results*, our own 8,760 hourly analysis of 2050 identified that with the assumed load and renewable load shapes, the model only faced one very short period of unserved energy (constituting 75 GWh, or about 0.02 percent of all load hours). We presume that there will be numerous tools to avoid potential unserved energy in 2050, including battery storage, flexible load resources, and regional integration. This type of analysis requires detailed, unit-specific stochastic reliability modeling beyond the scope of this analysis. While our analysis is technically rigorous and evaluates appropriate operating standards, because of the uncertainty out to 2050, further reliability analysis is required to evaluate other potential reliability issues.

Regardless of this fact, uncertainty of the technical limitations of operating a 100 percent clean energy system in 2050 should not be reason to limit today's deployment of critical solar, wind, and storage resources, particularly when wind and solar currently constitute less than 5 percent of TVA's operational capacity. Future IRPs should include a comprehensive view of system reliability, including correlated outages, weather patterns, and regional capacity sharing.[49]

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[48] *Overview of Winter Storm Elliott December 23, Maximum Generation Event*. MISO Reliability Subcommittee. January 17, 2023. Available at https://cdn.misoenergy.org/20230117%20RSC%20Item%2005%20Winter%20Storm%20Elliott%20Preliminary%20Report627535.pdf. Page 6.

[49] For more information on future alternatives to resource adequacy, we recommend *Redefining Resource Adequacy for Modern Power Systems*. ESIG. 2021. Available at https://www.esig.energy/wp-content/uploads/2022/12/ESIG-Redefining-Resource-Adequacy-2021-b.pdf.

3.7. TVA should account for non-electric benefits of a clean energy transition

As with this analysis, TVA's 2019 IRP includes estimates for impacts related to waste, water use, jobs, and land use. We recommend that future modeling endeavors go further and also quantify impacts related to public health, the social cost of carbon, and fuel savings outside of the electric sector; our analysis shows these are likely to be substantial in a future featuring levels of electrification consistent with TVA's electric-sector carbon-reduction goals.

4. CONCLUSION

Our 100% Clean Energy scenario shows that by completely switching away from fossil fuels in the electric sector in 2035, and by pursuing ambitious levels of electrification in the transportation, buildings, and industrial sectors, consumers in TVA's service territory can save $255 billion compared to a status quo "TVA Baseline" scenario. By pursuing a clean energy future, TVA can realize numerous benefits related to energy burden, job impacts, and public health while providing clean, reliable electricity to residents of the Tennessee Valley.

Appendix A. KEY SCENARIO INPUTS

Table 10 describes the primary assumptions used in the three scenarios analyzed in this study.

Table 10. Primary input assumptions for analyzed scenarios

		TVA Baseline	100% Clean Energy	Ambitious DER
Modeling Parameters	Topology	All of TVA's balancing area, including plants not owned by TVA and end uses not currently met via electricity from TVA	Same as "TVA Baseline"	Same as "TVA Baseline"
	Modeling horizon	2020-2050	Same as "TVA Baseline"	Same as "TVA Baseline"
	Temporal detail	Typical weeks (12 per year), 8 intervals per day	Same as "TVA Baseline"	Same as "TVA Baseline"
	Optimization period	Full-period optimization ("perfect foresight")	Same as "TVA Baseline"	Same as "TVA Baseline"
Load	Conventional end uses	Follows 2019 TVA IRP trajectory	Same as "TVA Baseline"	Same as "TVA Baseline"
	Energy efficiency	Follows 2019 TVA IRP trajectory	Ramps up to 1.5% annual savings as a % of sales	Same as "100% Clean Energy"
	LDV electrification	Follows 2019 IRP "1 Current" trajectory *(about 7 TWh by 2050.)*	Assumes that 99% of LDVs sold in 2030 are EVs *(About 50 TWh by 2050)*	Same as "100% Clean Energy"
	MDV/HDV electrification	Follows 2019 TVA IRP trajectory (none assumed)	Assumes that 60% of MDVs/HDVs sold in 2030 are EVs *(About 40 TWh by 2050)*	Same as "100% Clean Energy"
	Building electrification	Follows 2019 TVA IRP trajectory (none assumed)	Assumes that 100% of new equipment sold in 2030 are heat pumps *(By 2050 results in near-zero net-negative load addition due to baseboard heating replacement)*	Same as "100% Clean Energy"
	Industrial electrification	Follows 2019 TVA IRP trajectory (none assumed)	Non-electric demand electrifies according to MDV/HDV pathway (as this sector is similarly challenging to electrify). Based on 228 TWh/Quad assumption from EI's EPS analysis. *(About 112 TWh by 2050.)*	Same as "100% Clean Energy"
New conventional resources *(costs and tax credits, when allowed)*	Conventional gas	Allowed beginning in 2025, prices based on NREL's 2022 ATB	Same as "TVA Baseline"	Same as "TVA Baseline"
	Gas with CCS	Allowed beginning in 2025, prices based on NREL's 2022 ATB; includes 45Q tax credits	Same as "TVA Baseline"	Same as "TVA Baseline"
	Coal with CCS	Not currently modeled	Same as "TVA Baseline"	Same as "TVA Baseline"
	Adv. nuclear reactors / SMRs	Not currently modeled	Same as "TVA Baseline"	Same as "TVA Baseline"

		TVA Baseline	100% Clean Energy	Ambitious DER
New utility-scale clean energy resources *(costs and tax credits, when allowed)*	Utility-scale solar	Allowed beginning in 2024, prices based on NREL's 2022 ATB; includes options for both in-region PPAs and utility-owned solar; includes options for both PTC ($25/MWh) and ITC (30%); limited to 5 GW per year.	Same as "TVA Baseline"	Same as "TVA Baseline"
	Onshore wind	Allowed beginning in 2024, prices based on NREL's 2022 ATB; includes options for in-region PPAs, out-of-region PPAs, and utility-owned wind; includes PTC ($25/MWh); limited to 5 GW per year.	Same as "TVA Baseline"	Same as "TVA Baseline"
	Utility-scale battery storage	4- and 8-hour storage allowed beginning in 2024, prices based on NREL's 2022 ATB; Long-duration (50-hour) storage allowed beginning in 2030 according to 2021 LDES Council paper's "Conservative" central estimate: $2500/kW in 2025 declining to $1000/kW in 2040; includes ITC (30%); limited to 5 GW per year.	Same as "TVA Baseline"	Same as "TVA Baseline"
New distributed clean energy resources *(costs and tax credits, when allowed)*	Distributed solar	Follows "Base" case in 2019 IRP *(1.2 GW by 2030 and 2.7 GW by 2050)*	Follows "Medium" case in 2019 IRP *(1.7 GW by 2030 and 4.4 GW by 2050)*	Follows "High" case in 2019 IRP *(2.1 GW by 2030 and 6.3 GW by 2050)*
	Distributed battery storage	Follows "Base" case in 2019 IRP *(no additions)*	Follows "Medium" case in 2019 IRP *(25 MW by 2030 and 270 MW by 2050)*	Follows "High" case in 2019 IRP *(180 MW by 2030 and 1.1 GW by 2050)*
	Conventional demand response	Follows 2019 IRP: 1.9 GW by 2050	Same as "TVA Baseline"	Same as "TVA Baseline"
	Flexible load	None	Same as "TVA Baseline"	32 GW of flexible load by 2050, based on 2020 NREL potential study *(Components of flexible load vary by duration and price paid)*
Fuel costs	Gas	NYMEX in short term, AEO 2022 Reference case in mid- to long-term	Same as "TVA Baseline"	Same as "TVA Baseline"
	Coal	AEO 2022 Reference case	Same as "TVA Baseline"	Same as "TVA Baseline"

		TVA Baseline	100% Clean Energy	Ambitious DER
Existing fossil and nuclear and allowed retirements	Coal and gas	All plants currently listed as having an announced retirement retire no later than that date; plants are allowed to retire endogenously beginning in 2025	Same as "TVA Baseline"	Same as "TVA Baseline"
	Nuclear	Plants assumed to receive license extensions; IRA tax credits are assumed to prevent nuclear plants from retiring	Same as "TVA Baseline"	Same as "TVA Baseline"
Transmission	Within TVA	No internal constraints assumed; modeling TVA as a single electric region	Same as "TVA Baseline"	Same as "TVA Baseline"
	With regions adjacent to TVA	None assumed, except for PPAs *(From 2019-2021, average annual interchange was -1 TWh, or about 0.6% of total load)*	Same as "TVA Baseline"	Same as "TVA Baseline"
Reserve margins	Seasonal assumptions	17% summer (April-October), 25% winter (November-March)	17% year-round	Same as "100% Clean Energy"
Capacity contributions (ELCC)	Solar	1% winter, 50% summer (fixed systems) 1% winter, 68% summer (tracking systems)	Same as "TVA Baseline"	Same as "TVA Baseline"
	Wind	31% winter, 14% summer	Same as "TVA Baseline"	Same as "TVA Baseline"
	Other (nuclear, coal, gas, hydro, battery storage)	100% winter, 100% summer	Same as "TVA Baseline"	Same as "TVA Baseline"
	Flexible load	None present	None present	50% year-round

ATTACHMENT 2

Lead a 100% Clean Energy Revolution at TVA

May 10, 2023

We, the 6,658 undersigned, urge you to immediately chart a path to 100% clean energy by 2035 for the Tennessee Valley Authority. This would put the utility at the forefront of a nationwide energy transition from volatile, risky, and unreliable fossil fuels to distributed, resilient, lower-cost renewable energy. As leaders of the nation's largest public utility, you have the power and responsibility to make good on TVA's commitment to improve quality of life for all Tennessee Valley residents.

Communities across the region are facing the devastating realities of fossil fuel dependence, from intensifying climate disasters — like Winter Storm Elliot — to skyrocketing energy bills and increased health hazards. Rather than address this crisis by immediately transitioning to clean, affordable, and resilient energy — like rooftop solar and energy efficiency — TVA is doubling down on dirty energy.

TVA's most recent long-term planning document — the 2019 Integrated Resource Plan — projects a 4-gigawatt new fossil gas buildout and more than 34 million tons of carbon pollution in 2038. Just recently the utility decided to replace its retiring Cumberland coal plant with a massive gas plant and pipeline. On its current path, TVA won't achieve zero emissions until well past 2050.

This is a massive betrayal of TVA's 10 million customers who count on the utility to provide reliable, affordable, clean energy.

Luckily you have an opportunity to make things right in the upcoming plan and model the nationwide transition to 100% renewable energy we need to tackle the climate emergency and ensure energy security.

A groundbreaking study from Synapse, the Center for Biological Diversity, and Grid Lab demonstrates that TVA can achieve 100% clean energy by 2035 — and that doing so will put money in people's pockets, lower energy burdens, create thousands of new jobs, and improve public health. A plan that specifically boosts investment in distributed energy resources like rooftop solar would help increase grid resilience, lower costs, reduce land use, and diminish environmental damage.

TVA just announced its intention to develop a plan for reducing carbon pollution in the Tennessee Valley, an important step forward. But with few details and no commitment to meaningfully engage the public, it concerns me that instead of taking real climate action by prioritizing distributed renewable energy, TVA could turn to industry-friendly techno-fixes like carbon capture or massive infrastructure projects that will prolong our reliance on dirty energy and damage the environment.

I'm counting on you to push TVA to its fullest potential by charting a path to 100% clean energy by 2035 that maximizes distributed, renewable energy and prioritizes environmental and energy justice.

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Catherine Schramm, Lakewood, CO, 80215
Ari Schwartz, Teaneck, NJ, 07666
Jan Usinger Jeffries, Los Ranchos, NM, 87107
Myrna Torrie, Seattle, WA, 98105
Nancy Havassy, Oakland, CA, 94611
Amanda Salvner, Ann Arbor, MI, 48104
Debra Sutton, Barrington, IL, 60010
Kathleen Ritchie, Rochester Hills, MI, 48306
judy thomas, Beloit, WI, 53511
Sharon siodmak, Wallkill, NY, 12589
Jeffrey Blackman, Tucson, AZ, 85717
Edythe Cox, Braintree, MA, 02184
Sydney Davis, Santa Fe, NM, 87507
Roberta Schear, Oakland, CA, 94618
jon kiesling, Saint Louis, MO, 63119
Paul Borcherding, La Grande, OR, 97850
Thomas DiCarrado, Cornwall, NY, 12518
Taylor Reed, Houston, TX, 77051
Gary Carlson, Ventura, CA, 93004
Sally Seckman, , APO, 96326
Randy Willis, Durango, CO, 81301
Denise Saccone, Santa Fe, NM, 87501
Christopher Hall, Glendale, CA, 91203
Fayette Krause, Port Townsend, WA, 98368
Jim Yarbrough, Newbury Park, CA, 91320
Bob Kuhnert, Durango, CO, 81301
Jeffrey McCollim, Painesville, OH, 44077
Kathy Aub, Boca Raton, FL, 33431
Roberta Camp, Philadelphia, PA, 19147
Melanie Braunbeck, Phoenix, AZ, 85048
Alexa Wall, Leicester, MA, 01524
Gail Herr, Hobe Sound, FL, 33455
Joette Storm, Bend, OR, 97701
Beverly Bullock, New York, NY, 10036
Naomi Klass, Bethel, NY, 12720
Rebecca Muradian, San Rafael, CA, 94901
Libba Miller, Nashville, TN, 37212
Victoria Smith, Blairsville, GA, 30512
Jackie Johnson, Eugene, OR, 97404
Roger Martin, University Place, WA, 98466
Kim Smith, Beverly, WV, 26253
Barbara Tillman, North Bergen, NJ, 07047
Pamela Haun, Cooper City, FL, 33328
Malinda Plog, Scottsbluff, NE, 69361
Jessie Osborne, Oceanside, CA, 92057
Alan Jasper, Delray Beach, FL, 33484
Jerry Rivers, Roosevelt, NY, 11575
Christina Anderson, Los Alamos, NM, 87544
Martha Gorak, Katy, TX, 77450
Lynn Shoemaker, Whitewater, WI, 53190
lesley stansfield, Healdsburg, CA, 95448
Paul Russell, Rosendale, NY, 12472
Doreen Tignanelli, Poughkeepsie, NY, 12603
Amy Henry, Northampton, MA, 01060
Tricia Rizzi, Massapequa, NY, 11758
mary more, Flourtown, PA, 19031
Robert Posch, Orlando, FL, 32825
Elizabeth Marino, Goffstown, NH, 03045
Nancy Fifer, Lewes, DE, 19958
Jaedra Luke, Brevard, NC, 28712
Tina Ann, Bolinas, CA, 94924
Andrew Mueckenberger, Alameda, CA, 94501
James Kerr, Redwood Valley, CA, 95470
Susan kalan, Orange, VA, 22960
Scott C. Walker, Greensboro, NC, 27410
Patrice Wallace, Santa Cruz, CA, 95060
Geoffrey Simmons, Cincinnati, OH, 45208
Lanie Cox, Spokane, WA, 99224
Lauren Murdock, Santa Barbara, CA, 93110
Vernon DeWitt, Jonestown, TX, 78645
Anna Cowen, Oregon City, OR, 97045
Lynne Teplin, Bronxville, NY, 10708
Karen Matulina, St Augustine, FL, 32080
Christine Hein, Huntington Beach, CA, 92648
Lindi Higgins, Brewster, MA, 02631
Holly Hall, Temecula, CA, 92592
Jennifer Harrison, San Francisco, CA, 94131

A.L. Steiner, Los Angeles, CA, 90063-2604
Alice Gard, Naples, FL, 34102
Iris Rochkind, Flushing, NY, 11355
Mark Porter, Chicago, IL, 60641
Emily Van Alyne, West Richland, WA, 99353
Michael Brandes, Fort Lee, NJ, 07024
D Sizemore, Muscle Shoals, AL, 35662
Sharon Nolting, New York, NY, 10003
Alysha Edelman, Freeport, NY, 11520
Deborah Ebersold, West Hollywood, CA, 90046
Tom Hougham, Trafalgar, IN, 46181
Linda Hansen, Portland, OR, 97218
Lisa Graham, Madison Heights, MI, 48071
Mary Sorokie, Chicago, IL, 60640
Jan Modjeski, Murrells Inlet, SC, 29576
Janet Grossman, Prescott, AZ, 86305
Peggy Luna, Pleasant Hill, CA, 94523
Debbie Bolsky, Santa Monica, CA, 90403
June Brashares, Sebastopol, CA, 95472
Bruce Burns, Santa Cruz, CA, 95060
Barbara Brinkley, Jonesboro, AR, 72401
G. Paxton, New York, NY, 10009
John Feissel, Sonoma, CA, 95476
Julia DeNiro, Greensboro, NC, 27407
Gina Bates, Apple Creek, OH, 44606
David Doering, San Francisco, CA, 94109
Michael Madden, New City, NY, 10956
katherine dander, Boston, MA, 02113
Jeremy Carpenter, Latham, NY, 12110
Quentin Fischer, Roanoke, VA, 24018
Pam Lambert, Fort Collins, CO, 80525
CHRISTINE L PORTER, Chico, CA, 95973
Urmila Padmanabhan, Fremont, CA, 94538
Kevin Crupi, Marquette, MI, 49855
Shirley Davis, Orono, ME, 04473
Jean Naples, Suffern, NY, 10901
Lisa Isley, Mill Valley, CA, 94941
Linley Fray, Phoenix, AZ, 85028
Mary Kraeszig, Zionsville, IN, 46077
Carol Baier, Kirksville, MO, 63501
Joanna Leary, Westbrook, ME, 04092
Kelly Collins, Santa Rosa, CA, 95401
Stephen Hunt, Birmingham, AL, 35242
Laurie Rittenberg, Studio City, CA, 91604
Linda Frankel, Hurst, TX, 76053
Loraine Ferrara, Braintree, MA, 02184
Mary Levitt, Palisades, NY, 10964
Jamie Scott, Pasadena, CA, 91105
Molly Swabb, Donnelly, ID, 83615
Addie Jacobson, Bellingham, WA, 98229
Laura Guttridge, Vero Beach, FL, 32963
Bev Spector, San Francisco, CA, 94121
Marilyn Martin, Rockville, MD, 20852
Maureen Dale, Saranac Lake, NY, 12983
DORELLE ACKERMANN, Mokena, IL, 60448
Tarun Bishop, Portland, OR, 97219
Tessa Pou, Spotsylvania, VA, 22553
Charity Moschopoulos, Annandale, VA, 22003
vanessa quintero, Concord, CA, 94521
Amy Holt, Fitchburg, WI, 53711
Pamela Joyce, Portland, OR, 97203
susan ponchot, Sunrise, FL, 33351
Marilyn Thompson, Grand Junction, CO, 81501
Kimberly Bouchard-Shapiro, Durham, CT, 06422
Elizabeth Darovic, Monterey, CA, 93940
Lawrence Hilf, Rochester, NY, 14618
Allison Ostrer, Seattle, WA, 98146
Lynn Driessen, Appleton, WI, 54915
Cheryl Albert, Freedom, CA, 95019
Craig Emerick, Corvallis, OR, 97330
Sandy Stuhaan, Tucson, AZ, 85719
Mark S. Weinberger, Daly City, CA, 94015
Cori Bishop, Egg Harbor City, NJ, 08215
Glenn Secor, Louisa, VA, 23093
Richard Glinski, Alden, NY, 14004
Douglas Cooke, Brooklyn, NY, 11209
Thomas Hicks, Tucson, AZ, 85718
Roger Williams, Indianapolis, IN, 46278
Nikki Nicola, Davis, CA, 95616
Gilda Levinson, Coral Springs, FL, 33071
Kent Minault, Knoxville, TN, 37917
Judy Fore, Black Mountain, NC, 28711
Scott Ferguson, Bloomington, IN, 47401
J Lasahn, El Cerrito, CA, 94530
Tania Malven, Tucson, AZ, 85719
Kenneth Pennington, Ventura, CA, 93001

Maryann Smale, Pottstown, PA, 19465
Tom Butler, San Jose, CA, 95124
Thomas Marziale, Akron, OH, 44301
Michael Lee, Peoria, AZ, 85383
Joel Masser, San Jose, CA, 95124
Juan Hernandez Garibay, El Paso, TX, 79915
Cheryl Watters, Daytona Beach, FL, 32114
Candace Volz, Austin, TX, 78752
Valerie Brown, Denver, CO, 80203
David Suarez, Brooklyn, NY, 11234
Rebecca Martin, Sacramento, CA, 95835
Sherry Reisch, New York, NY, 10023
Dianne Doochin, Nashville, TN, 37205
Andrew Isoda, Lahaina, HI, 96761
James Lindsay, Akron, OH, 44313
John Dodge, Homer, AK, 99603
EM Wilkinson, Redwood City, CA, 94062
Judy Landress, Ozona, TX, 76943
Jane Chischilly, Texarkana, TX, 75501
Gisela Schloss-Birkholz, Roswell, GA, 30075
Katherine Hutchins, Phoenix, AZ, 85050
Cathy Sleva, Seal Beach, CA, 90740
Jonathan Hartman, Camas, WA, 98607
Lucie Laberge, Charlotte, NC, 28270
Douglas Hammer, Oakland, CA, 94610
Karen Luckini, Morgantown, WV, 26508
Lauren Prust, San Diego, CA, 92126
Michael Kenney, El Cerrito, CA, 94530
Alyza Cornett, Los Angeles, CA, 90056
Chris Rose, Petaluma, CA, 94952
Alan Thomas, Tacoma, WA, 98411
Marielle Marne, Phoenix, AZ, 85086
Susan R Kilgore, Natick, MA, 01760
Laura Michaels, Maple Glen, PA, 19002
mark semet, Kansas City, KS, 66112
Lenore Sivulich, New Gloucester, ME, 04260
Nancy Bolan, Mount Vernon, NY, 10552
Geness L Lorien, Santa Barbara, CA, 93101
Eli Celli, Chapel Hill, NC, 27516
Katharine Molnar, Winsted, CT, 06098
Max Salt, Coventry, RI, 02816
Pamela Patek, La Honda, CA, 94020
Carol Lutken, Oxford, MS, 38655
Jenny Bramlette, Bridgeport, AL, 35740
Paul Tescher, Athens, OH, 45701
Christine Reeder, Sebring, FL, 33872
Lauren Tartaglia, Brooklyn, NY, 11249
Bo Breda, Pahoa, HI, 96778
Sandra Sobanski, Brooklyn, NY, 11218
VALERIE HOWELL, Coral Gables, FL, 33146
Michael Rynes, Naperville, IL, 60540
Kacy Harnedy, Manchester, NH, 03104
Deborah Wertz, Lafayette, IN, 47904
Derek Gendvil, Las Vegas, NV, 89117
Nancy Hartman, Lafayette, CA, 94549
Wayne Gibb, Forestville, CA, 95436
Linda Jones, Cornville, AZ, 86325
Drew Martin, Lake Worth, FL, 33460
Travis Israels, Spencer, IA, 51301
Michael Olenjack, Saint Louis, MO, 63109
Roger Schmidt, Middleton, WI, 53562
karen rudy, New Cumberland, PA, 17070
Sylvia Cardella, Hydesville, CA, 95547
Carol Hartzell, Hudson, IL, 61748
Linda Prandi, Sacramento, CA, 95834
Marie A. Curtis, Oakhurst, NJ, 07755
Daniel Godshall, Colorado Springs, CO, 80920
Patricia Poock, Hernando, FL, 34442
Laurie LaGoe, Alexandria, VA, 22309
Gianina Grahan, Redmond, WA, 98052
Sue Halligan, Stillwater, MN, 55082
Georgia Shankel, Chicago, IL, 60624
Guy Chan, Seattle, WA, 98195
Betsy Maestro, Clarkdale, AZ, 86324
Jennifer Liptow, Farmington, MI, 48336
Carol Metzger, Kents Store, VA, 23084
Leo Elizabeth Alonzo, Santa Fe, NM, 87507
Jeffrey Hemenez, San Ramon, CA, 94583
Sharon LaLond, Oro Valley, AZ, 85704
Ruben D. Arvizu, Marietta, GA, 30064
Kit Long, Napa, CA, 94559
Marilyn Perona, Laguna Woods, CA, 92637
Claudia Ezinicki, Lancaster, MA, 01523
Linda Murphy, Hyattsville, MD, 20782
Debra Berlan, Garfield, NJ, 07026
Marsha Smith, Murfreesboro, TN, 37127

Kristin Womack, San Anselmo, CA, 94960
Sandi Redman, Skokie, IL, 60077
Marcia Godich, Trafford, PA, 15085
Barbara Harrison, Ithaca, NY, 14850
Cheryl Biale, Olympia, WA, 98512
Jody Goldstein, Rochester, MN, 55904
Lorne Beatty, Carleton, MI, 48117
Kenneth Thompson, Saint Clair Shores, MI, 48080
MARJORIE BROWNING, Benson, AZ, 85602
Sarah Clauser, Wallingford, PA, 19086
Chelsea Berg, , BC, V9B 6X6
Kenneth Hittel, New York, NY, 10024
Jenny And David Mapes, Colebrook, CT, 06021
John Geiger, Jasper, GA, 30143
richard acosta, Miami, FL, 33155
Shiela Cockshott, Belmont, CA, 94002
JAMES FEICHTL, Belmont, CA, 94002
Fran FrainAguirre, Denver, CO, 80211
Kate Skolnick, Brooklyn, NY, 11238-2789
Eileen Fonferko, North Port, FL, 34286
Susan Querze, Lawrence, MA, 01843
James TRUE, Oakland, CA, 94618
Deborah Spencer, Billerica, MA, 01821
Adria Siraco, Port St Lucie, FL, 34983
Christine Frank, Mankato, MN, 56001
Tami Hillman, Cocoa Beach, FL, 32931
Susan Dellinger, Denver, CO, 80219
Susanne Bader, Grass Valley, CA, 95945
George Ruiz, San Carlos, CA, 94070
Claudia Reed, Bokeelia, FL, 33922
Myra Dremeaux, Mount Kisco, NY, 10549
Mary Schroeder, Miami, FL, 33180
Llll D, Berkeley, CA, 94706
Carol Black, Valparaiso, IN, 46383
Pamela Ball, San Leandro, CA, 94577
Megan Ottens-Sargent, Aquinnah, MA, 02535
Jayne Knoche, Sierra Vista, AZ, 85650
Debra Lichstein, Agoura Hills, CA, 91301
Johanna Abate, San Francisco, CA, 94109
Brad Walker, Poplar Grove, IL, 61065
Steven Federman, Ottawa Hills, OH, 43606
john carmichael, Cincinnati, OH, 45202
Freddie Williams, Blackstone, MA, 01504
Jean Marie VanWinkle, Bedford, VA, 24523
William Roberson, Brooklyn, NY, 11226
Patricia Mckinley, Chicago, IL, 60611
Nicolas Duonn, Santa Ana, CA, 92705
Kay Merica, Hope, ID, 83836
Sandra Stock, Tucson, AZ, 85710
Duane Sebesta, Pembroke Pines, FL, 33028
Meher Behrana, , Sydney NSW, 02064
Susan Sloan, Los Angeles, CA, 90064
Lily Doris, Laguna Niguel, CA, 92677
Nancy Benner, Belding, MI, 48809
Susan Hanger, Topanga, CA, 90290
Christy Hanna, Knoxville, TN, 37919
sara stepnicka, Phoenix, AZ, 85022
Hugh Curtler III, Brooklyn Park, MN, 55443
Brenda Staab, Virginia Beach, VA, 23457
Jason Klinkel, Newport, RI, 02840
Carol Myers, Oceanside, NY, 11572
Dennis Schaef, Meadville, PA, 16335
Tina Brown, Anacortes, WA, 98221
Dorothy Jordan, Lynden, WA, 98264
Kerry Dietz, Claymont, DE, 19703
KATHARINE CHRISTMAS, River Forest, IL, 60305
Carol George, Raleigh, NC, 27612
Sue Mozian, Basalt, CO, 81621
Steve Lustgarden, Santa Cruz, CA, 95062
William McCullough, Chapin, SC, 29036
Ellen Morgan, La Grange, IL, 60525
Kim Colangelo, Flagstaff, AZ, 86003
I. Engle, Tularosa, NM, 88352
Steven Cook, Seminole, FL, 33778
Annette Jewell-Ceder, Ham Lake, MN, 55304
Rachael Pappano, Mattawamkeag, ME, 04459
Steve Schueth, Chicago, IL, 60613
Jennifer Bradley, Santa Monica, CA, 90404
Jacqueline Wolfe, Calumet, MI, 49913
Sandra Lambert, Mansfield Center, CT, 06250
Madilyn Fox, Waveland, MS, 39576
Lynn C. Lang, Saint Cloud, MN, 56303
Laura Bernstein, Alameda, CA, 94501
John Vickery, Denver, CO, 80212
Ronald Jacob, San Jose, CA, 95117
joyce cotter, Decatur, GA, 30033

Sandy Schott, Kalispell, MT, 59901
Linda Thompson, Houston, TX, 77074
Kathleen Furness, North Pole, AK, 99705
Elizabeth Butler, Henderson, KY, 42420
Cathy Martin, Smyrna, GA, 30080
Tika Bordelon, Seattle, WA, 98101
Tammy Shaw, Scottsdale, AZ, 85254
Joe Salazar, Santa Rosa, CA, 95407
Lisa Roberts, Cincinnati, OH, 45211-5716
Ronald Sverdlove, Princeton, NJ, 08540
Ira Gerard, South Elgin, IL, 60177
Alexa Morgan, Peoria, AZ, 85382
Karen PETERSON, Northbrook, IL, 60062
Marian Carter, Elkton, OR, 97436
Carol Johnson, North Aurora, IL, 60542
Querido Galdo, Gualala, CA, 95445
Conrad Szablewski, Kennett Square, PA, 19348
William Tarbox, Magnolia, TX, 77355
Wister Miller, Fort Collins, CO, 80525
Alan Harper, Richmond, VA, 23225
Jacqueline Baudouin, DPO, AE, 09808
Susanna Purucker, Miami Beach, FL, 33139
Dianna Torson, Brookings, SD, 57006
Jeffery Biss, Elgin, IL, 60120
Chris Washington, New York, NY, 10019
Kay Lambert, Glenwood, MN, 56334
eric Nylen, Santa Cruz, CA, 95060
Joseph Wiley, Cincinnati, OH, 45236
Heather Turbush, Wading River, NY, 11792
Gordon James, Denver, CO, 80222
Maureen Allen, Talking Rock, GA, 30175
Nancy Carter, Morro Bay, CA, 93442
fay forman, New York, NY, 10001
David Linnane, Salisbury, NH, 03268
Bonnie Rhoads, Palmyra, PA, 17078
Cynthia Bernett, Concord, NC, 28027
Ann Wiseman, Mansfield, IL, 61854
Debora Ley, Falls Church, VA, 22046
Paulette Zimmerman, Saint Louis, MO, 63139
Margaret Murray, Brooklyn, NY, 11223
David Leavitt, Ann Arbor, MI, 48103
Stuart Francis, Cedar Rapids, IA, 52402
Aleksandra Zamorska, , , 51-659
Ann Felicetti, Middletown, DE, 19709
Mike Hansen, Deerfield, IL, 60015
Edie Dillon, Prescott, AZ, 86303
Kate Babb, Tucson, AZ, 85711
Christian Tabone, Bolivar, NY, 14715
Helen Buchanan, Milmont Park, PA, 19033
Pam Freilich, Dunbarton, NH, 03046
Gennaro F. DeLucia, Somerset, NJ, 08873
Tom Pitman, Burbank, CA, 91506
Nancy White, Spokane Valley, WA, 99216
Jody Isenberg, San Bernardino, CA, 92413
Michelle Madole, Huntington Beach, CA, 92647
D Schoech, Arlington, TX, 76012
Susan Peterson, Houghton, MI, 49931
Nelson Molina, Buena Park, CA, 90620
Gladys Delgadillo, Los Angeles, CA, 90016
Leslie Shipley, , , 60611
Maureen LoCascio, Blakeslee, PA, 18610
ANDREW ROBBINS, New York, NY, 10023
Gail McDonough, Wenatchee, WA, 98801
Tina Wener, Morro Bay, CA, 93442
Donald Evans, Broomfield, CO, 80020
Richard Lee, Salinas, CA, 93907
Cara Schmidt, Yellville, AR, 72687
Anne Aguilera, Cranston, RI, 02920
Elizabeth Rutledge, Williamsburg, VA, 23188
Lauren Schiffman, El Cerrito, CA, 94530
Jamie Le, Alameda, CA, 94501
Margo Reeg, Whittier, CA, 90603
D'Arcy Goodrich, Omaha, NE, 68164
Andrew Wadsworth, Reading, PA, 19606
Jared Cornelia, Wilmington, DE, 19804
Susan Balaban, Wilmette, IL, 60091
Darian Mark, New York, NY, 10022
D Stirpe, Portland, OR, 97214
Henry Kimbell, Rio Rancho, NM, 87144
Barbara Tosh, Seaside, CA, 93955
Mary Bissell, Rio Rancho, NM, 87144
William Klock, Fort Worth, TX, 76112
Carol Leonis, Waite Hill, OH, 44094
Gary Beven, Friendswood, TX, 77546
Carol Collins, Dover, DE, 19904
David Henning, Marshfield, WI, 54449

Sally Bartow, Mercer Island, WA, 98040
Melissa K, South Heights, PA, 15081
Tracy Templin, Isle, MN, 56342
Harry Harrison, Old Orchard Beach, ME, 04064
Mary Hahn, Spring Green, WI, 53588
Jennifer Barton, New York, NY, 10002
Julie Berberi, Saint Charles, IL, 60175
John Doucette, Pawtucket, RI, 02861
Karen Kravcov Malcolm, Scottsdale, AZ, 85262
Laurie Sargent, Livermore, CA, 94550
Ginny Barber, Greenwood, VA, 22943
Lorren James, Aurora, CO, 80016
Ginger Young, Spring, TX, 77379
Dena Maguire Young, Dahlonega, GA, 30533
Karen Furniss, Brisbane, QLD, 04017
Kathleen Lee, Lacey, WA, 98503
William Forrest, Rochester, NY, 14608
Mary Puglia, Gold Canyon, AZ, 85118
Milan Sandhu, Columbia, MD, 21044
Sharma Gaponoff, Grass Valley, CA, 95949
Marilyn Koff, North Las Vegas, NV, 89031
Stephanie Lee, West Palm Beach, FL, 33411
Elizabeth Herten, Cleveland, OH, 44135
David DePrez, Orland, ME, 04472
Debbie McCarthy, Phillips, ME, 04966
Don Stutheit, Edmonds, WA, 98026
Ellen Brouillet, Berwick, ME, 03901
Nancy Treffry, Aromas, CA, 95004
Kimberly Wade Barcia, Philmont, NY, 12565
Aggie Monfette, Royal Oak, MI, 48073
Craig Markson, Santa Barbara, CA, 93101
Damon Brown, Los Angeles, CA, 90016
Keiko Barrett, San Diego, CA, 92101
Kathleen Doyle, Golden, CO, 80403
alison merkel, Oak Park, CA, 91377
Nina French, Portland, OR, 97220
Lisa Gherardi, Los Gatos, CA, 95032
Jane Schlegel, Hydes, MD, 21082
Sarah Peters, Silver Spring, MD, 20910
Antonino Erba, Dubuque, IA, 52001
Tina Peak, Palo Alto, CA, 94301
Cindy Fine, Spring Hill, KS, 66083
Bill Capasso, Lincoln, VT, 05443
Andrea Cimino, Kensington, MD, 20895
Robert Johnson, El Segundo, CA, 90245
Brian Gibbons, Cleveland, OH, 44126
Kristina Fukuda, Los Angeles, CA, 90034
Theresa Lianzi, Fort Myers, FL, 33913
Sylvia Rodriguez, New York, NY, 10003
Jamie Morvitz, Norwalk, CT, 06851
Jerome Roth, Tempe, AZ, 85281
Michael DeLoye, Boynton Beach, FL, 33426
James Martin, Buffalo, NY, 14224
Krystal Krause, Buffalo, NY, 14216
Larry Lambeth, Springfield, MO, 65810
James Turner, Merritt Island, FL, 32952
Martha Jones, Santa Clarita, CA, 91350
Sylvia Ruiz, Los Angeles, CA, 90086
Starla Wallace, Peoria, IL, 61604
Leslie Smith, Oakland, CA, 94611
Kathleen Fox, San Luis Obispo, CA, 93401
Jess Summers, Rockville, VA, 23146
Allison Argo, Brewster, MA, 02631
Gail Clendenen, Gainesville, GA, 30506
S. E. Williams, Stafford, TX, 77477
David Williams, Elkmont, AL, 35620
Vicki Wiker, San Clemente, CA, 92672
Michael Klausing, Nitro, WV, 25143
jeffetey kramer, Brooklyn, NY, 11234
Phyllis Chavez, Santa Monica, CA, 90405
Paul Moser, Richfield, OH, 44286
Alison McGinty, Golden, CO, 80403
Denise Louie, San Francisco, CA, 94131
Lance Jones, Sarasota, FL, 34234
Alan Stultz, Annandale, NJ, 08801
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Patricia Quinn, Norfolk, VA, 23503
Cynthia Snyder, San Diego, CA, 92106
Anna Schneider, San Leandro, CA, 94577
Michelle Sewald, Denver, CO, 80202
Alan Peltzer, Parkton, MD, 21120
Mary Adam, Bryan, TX, 77808
Connie Toops, Marshall, NC, 28753
Chuck Rocco, Simi Valley, CA, 93065
Chris Crosley, Ladys Island, SC, 29907
Judy Shively, San Diego, CA, 92101

Shani Schulman, Ozone Park, NY, 11417
Alice West, Grand Marais, MN, 55604
Peter Burval, Hillside, NJ, 07205
Jj Eck, Chandler, AZ, 85286
Elizabeth Hemzacek, Willowbrook, IL, 60527
Patrick Hamilton, Saint Augustine, FL, 32080
Judy Williams, Caliente, CA, 93518
Carl Prellwitz, Dover, NH, 03820
Charles Rinear, Gibbstown, NJ, 08027
Lisa Jefko, Roscoe, IL, 61073
Ruth Kastner, Gloversville, NY, 12078
Linda Waldroup, Walnut Creek, CA, 94595
Rose Marie Wilson, Wantagh, NY, 11793
Kenneth Lapointe, Los Angeles, CA, 90031
Jody Lewis, Grand Junction, CO, 81501
Shirley Jenkins, Durham, NC, 27707
Georja Umano, Santa Monica, CA, 90405
Steven Fenster, Pemberton, NJ, 08068
Michael Talbot, San Rafael, CA, 94901
Carrie Luce, Gladstone, MO, 64118
Christine Angeles, Burlingame, CA, 94010
Sarah Stiles, Santa Rosa, CA, 95405
Jeff Howe, Fort Lauderdale, FL, 33308
Sue Perry, Asheville, NC, 28804
Robert Dornfeld, Athens, TN, 37303
Ji-Young Kim, Bothell, WA, 98012
Krista Dana, Sunnyvale, CA, 94087
Christy Spear, Isle, MN, 56342
LINDA MARSHALL, Arnold, MD, 21012
Thomas Johnson, Blowing Rock, NC, 28605
Nicola Nicolai, Chester Springs, PA, 19425
Deborah Walsh, Boxford, MA, 01921
John Miller, Irvine, CA, 92618
Miguel Ramos, Turlock, CA, 95382
martha wing, Oakland, CA, 94618
HEIDI HOLLORAN, Kahului, HI, 96732
georgia goldfarb, Malibu, CA, 90265
Thaddeus Kozlowski, Lacey, WA, 98503
Chris Busby, Watertown, TN, 37184
Patricia Lamonica, Bentonville, AR, 72712
Ernie Walters, Union City, CA, 94587
Doris Briggs, Beech Island, SC, 29842
Anne Smith, , , 82634
Jim Petkiewicz, San Jose, CA, 95125
Janice Dutka, North Olmsted, OH, 44070
Debra Csenge, Kanab, UT, 84741
Teresa Yrastorza, Berkeley, CA, 94702
Larry Brandt, Cathlamet, WA, 98612
Janie Thomas, Eugene, OR, 97402
John Franklin, Raleigh, NC, 27614
Scott Harrison, Gig Harbor, WA, 98332
Anne Barker, San Rafael, CA, 94903
Jamie Rodriquez, Lexington, OK, 73051
Chrissy Bailey, Spokane, WA, 99201
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Liz Mahony, New York, NY, 10025
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Cristian Ramis, , Essex, SS9 3LG
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Jeremiah Graff, Sheboygan, WI, 53081
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Melanie Cummings, , Orihuela, 03319
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Glenda Larsen, Gering, NE, 69341
Annette Nelson, Bronx, NY, 10470
Kimberly Teraberry, Seattle, WA, 98112
Dan Stanger, Newton, MA, 02459
Robert Hays, Corrales, NM, 87048
Megan Narasimhan, New Orleans, LA, 70118
Susan Jordan, Golden Valley, MN, 55422
Maureen May, Nashville, TN, 37212
Lucia Pollock, Washington, DC, 20037
Tova Cohen, Brooklyn, NY, 11229
Jean Trapani, Nokomis, FL, 34275
Bernadette Payne, Chicago, IL, 60634
Ruth Schellbach, Salem, OR, 97302
Kathleen Jones, Wayzata, MN, 55391
Jill Madsen, Colorado Springs, CO, 80918
Carolyn Riley, Madison, WI, 53703
Gary Hull, Clearfield, UT, 84015
Michelle Irvin, Vincennes, IN, 47591
J Noble, Fitchburg, WI, 53711
Kathy Casiello, Lisle, IL, 60532
Linda Delaney, Spotsylvania, VA, 22553
Marshal McKitrick, Sacramento, CA, 95822
Denise LaChance, Winnetka, CA, 91306
Diane Krassenstein, Phila, PA, 19111
Megan Eding, Alameda, CA, 94501
Beverly Cowling, Toney, AL, 35773
Michael Gross, Foster, OR, 97345
Jennifer Bambauer, Prescott Valley, AZ, 86314
LouAnn Lanning, Saint Louis Park, MN, 55426
oja Fin, Fort Bragg, CA, 95437
Erica Munn, Los Angeles, CA, 90028
Connor Hansell, Salt Lake City, UT, 84121
Catherine Nelson, Fort Myers, FL, 33913
Raymond Holder, Cedar Rapids, IA, 52406
Carol Zahn, Omaha, NE, 68116

Ann McDermott, Litchfield Park, AZ, 85340
virginia johnson, Mountain Lakes, NJ, 07046
Darlene Wolf, Naples, FL, 34102
Sheila Miller, Longmeadow, MA, 01106
Melissa Suarez, Cleveland, OH, 44135
Carolyn Repeta Repeta, Sarasota, FL, 34241
Sejon Ding, Los Angeles, CA, 90064
Eleanor Weisman, Knox, ME, 04986
Harold T. Hodes, Ithaca, NY, 14850
Honey Mae Basye, Fuquay Varina, NC, 27526
David Luboff, Burbank, CA, 91501
C. Yee, Sacramento, CA, 95831
Angela Carter, San Pedro, CA, 90731
Winston Huang, West Des Moines, IA, 50265
Karen Asta-Ferrero, Agawam, MA, 01001
Denis Petitt, Henderson, NV, 89044
Brandy Horne, Colorado Springs, CO, 80922
Bryan VanDuinen, Whitmore Lake, MI, 48189
Ruth Stoner Muzzin, Montara, CA, 94037
Dorothy Jackson, Newtown, PA, 18940
Arlene Zuckerman, Forest Hills, NY, 11375
Sue Hayden, Bahama, NC, 27503
angela wilson, Troutville, VA, 24175
Kathy Bradley, Lugoff, SC, 29078
Frank Gonzalez, San Juan, PR, 00936
Steven Sy, East Lansing, MI, 48823
Linda Olson, Duluth, MN, 55805
Shaun Knutsen, Brooklyn, NY, 11209
Wendy Ruggeri, Naugatuck, CT, 06770
Grant Bacon, Wilmington, DE, 19805
Bill Staley, Sterling, VA, 20164
Steve Schildwachter, Winter Garden, FL, 34787
Lisa-May Reynolds, Beaufort, SC, 29907
Sherrill Gary, Pinehurst, GA, 31070
Daniel McKeighen, Rocklin, CA, 95765
Jeanette King, Livermore, CA, 94550
Dale LaCognata, Indianapolis, IN, 46256
Sandra Lubrano, Marlton, NJ, 08053
Heidi Hart-Zorin, Portland, OR, 97214
Stephanie Witkoski, Davie, FL, 33324
Corri Gottesman, Lansdale, PA, 19446
Denise Curry, Philadelphia, PA, 19143
Martin Horwitz, San Francisco, CA, 94122
Veronica Heron, Phoenix, AZ, 85018
Lisa Neste, High Point, NC, 27265
Amy Fisher, Lacey, WA, 98503
Reade Adams, , , 55108
Denise Marie Halbe, Sonoma, CA, 95476
F. Carlene Reuscher, Costa Mesa, CA, 92626
Heather Johnson, Lynn Haven, FL, 32444
Angel Orona, Alhambra, CA, 91803
Mary Ann Hardziej, Pleasant Ridge, MI, 48069
Caterina Janacua, Sherman Oaks, CA, 91423
Nina Hamilton, Pittsburgh, PA, 15232
Stacy Cornelius, Laguna Beach, CA, 92651
Robert Ludwig, Frisco, TX, 75035
Kyle Ullman, Gosport, IN, 47433
TIA TRIPLETT, Los Angeles, CA, 90066
Diane Switalski, Seminole, FL, 33772
Mary Burek-Faber, Oregon, WI, 53575
Robert Levitt, Fort Collins, CO, 80525
Iris Patty Yermak, Wilmington, DE, 19809
Caylee Gabbott, Salt Lake City, UT, 84121
Carol Moore, Beaverton, OR, 97008
Rita Lemkuil, Two Rivers, WI, 54241
ANNE Markey JONES, Winston Salem, NC, 27104
Mary Link, Ashfield, MA, 01330
Matt Kroner, Quincy, IL, 62305
Jordan Azzopardi, Dublin, OH, 43016
Carmine Profant, Minneapolis, MN, 55407
Virginia McIntosh, Philadelphia, PA, 19119
Sabrina Furman, Boise, ID, 83701
tevet tee, Los Angeles, CA, 90065
Joy Kroeger-Mappes, Frostburg, MD, 21532
Roberta Swanson, Hamilton, MI, 49419
Caryn Lerman, Hot Springs, SD, 57747
Carol Gordon, Los Angeles, CA, 90027
Debbie Carroll, West Chester, OH, 45069
MaryRose Randall, Rock Hill, SC, 29730
C Day, Vero Beach, FL, 32960
Allyson Finkel, Rancho Santa Margarita, CA, 92688
bill lamorte, Worth, IL, 60482
Sharon Burke, Seattle, WA, 98126
Margot Lowe, Oceanside, CA, 92056
James Felizola, Olympia, WA, 98502
Gwenna Weshinskey, Montgomery, IL, 60538

Nancy Ball, Sioux Falls, SD, 57104
Tara Brantley, Montevallo, AL, 35115
Richard Taylor, Hercules, CA, 94547
Nadine Godwin, New York, NY, 10075
Jack Polonka, Peekskill, NY, 10566
Suresh Dianand, Brooklyn, NY, 11208
Donald Harland, Candler, NC, 28715
M Masek, Danville, CA, 94526
Edwin Tobias, Purcellville, VA, 20132
Julia Stevenson, Washington, DC, 20008
Grace Gutierrez, Buckeye, AZ, 85396
Gene Whitaker, Orange, VA, 22960
Carol Book, York, PA, 17406
Trina Novak, Needham, MA, 02492
Alison Barrera, Redwood City, CA, 94061
Jen Frank, Sherrills Ford, NC, 28673
JL Mulligan, Charlottesville, VA, 22901
Brian Kalimian, New York, NY, 10028
Brenda Taylor, Austin, TX, 78739
Keitha Farney, Glenmont, NY, 12077
Jennifer Schally, Stillwater, MN, 55082
Tammy Nogles, Bryn Mawr, PA, 19010
Helen Greer, Tucson, AZ, 85705
Catherine Saint-Clair, Stuart, FL, 34997
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Eric Dallin, Gulfport, MS, 39503
Sarah Cutler, Blaine, WA, 98230
Joy Strasser, Davenport, IA, 52806
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Jerami Prendiville, Santa Rosa Valley, CA, 93012
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Waltraud Buckland, Berkeley, CA, 94708
Mary Stone, Oriental, NC, 28571
Jennifer Johnson, Belvidere, IL, 61008
Pat Petro, Arlington, VA, 22205
Juanita Hull, Clearfield, UT, 84015
Susan Larson, Paso Robles, CA, 93446
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Natalie Alexander, Kaneohe, HI, 96744
Jessica LoCicero-Walsh, Flagstaff, AZ, 86005
Paul Palla, Greencastle, PA, 17225
Leslie Brown, Salt Lake City, UT, 84111
Barbara Sorgeler, Long Neck, DE, 19966
Adrian Smith, Moncure, NC, 27559
Polly Lewis, Frazier Park, CA, 93225
Michele Halligan, Aptos, CA, 95003
Stephen Hatcher, Ruckersville, VA, 22968
Pat Wolff, Bainbridge Island, WA, 98110
William Baker, Mineral Wells, TX, 76067
Elizabeth Mather, San Diego, CA, 92129
Sherri Fryer, Clymer, PA, 15728
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Jackie Tryggeseth, North Freedom, WI, 53951
Wallace Elton, Middlebury, VT, 05753
David Rieckmann, Pardeeville, WI, 53954
Douglas Engle, Fort Pierce, FL, 34951
Kris Strate, Fairview, UT, 84629
Vicky Brandt, Durham, NC, 27705
Alison Zyla, Clinton, CT, 06413
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JESSICA CLAUDIO, Young America, MN, 55397
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Sandra Breakfield, Dallas, TX, 75236
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LuAnn McVicker, San Francisco, CA, 94117
Elizabeth Lotz, Santa Rosa, CA, 95407
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Bharat Adarkar, Manalapan, NJ, 07726
Richard Van Aken, Holland, PA, 18966
Gerald Kretmar, Saint Louis, MO, 63144
Dave Ruud, Portland, OR, 97231
Mari Mennel-Bell, Pompano Beach, FL, 33062
Cindy Lewis, Templeton, CA, 93465
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Al Belmonte, Aptos, CA, 95003
Amber Abascal, San Antonio, TX, 78232

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Suzanne Shaffer, Spring Grove, PA, 17362
Annika Swenson, Seattle, WA, 98116
Susie Cassens, Fort Pierce, FL, 34954
Lisa Pezzella, Clearwater, FL, 33755
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Yma Corrales, Miami, FL, 33193
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Kimra Ross, Joplin, MO, 64801
Paula Morgan, Winter Springs, FL, 32708
HEATHER WALKER, Saint Louis, MO, 63110
Theodora Boura, Boston, MA, 02135
Sandra Kurtz, Chattanooga, TN, 37408
Suzanne Lamuniere, New York, NY, 10025
Alexia Ferranti-Neilson, Tucson, AZ, 85710
Cristina Fiorillo, New York, NY, 10128
Huntley Hennessy, Los Lunas, NM, 87031
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Andrea Amari, Boulder, CO, 80304
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Dale Kelley, Port Ludlow, WA, 98365
Julia VETRIE, Canyon Country, CA, 91387
Sherri Wiegman, Cheboygan, MI, 49721
Alex McVey, Springfield, MO, 65803
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Sharon Briggs, Phoenix, AZ, 85024
Molly Sullivan, Kingwood, TX, 77345
Yves DeCargouet, Lucerne, CA, 95458
Kathy Olalde, Marietta, GA, 30060
July Sanders, Burlington, VT, 05401
Tim Fisher, Marlton, NJ, 08053
Ginnie Preuss, Bridgeport, CT, 06606
jeannie Pollak, Oxnard, CA, 93036
Cherie Fernandez, Galveston, TX, 77550
Pamela Woods, Hilton Head Island, SC, 29926
Kathleen Espamer, Camp Hill, PA, 17011
John Everett, Grass Valley, CA, 95945
Kathryn Deiss, Downers Grove, IL, 60516
Kathryn Kaffer, Tucson, AZ, 85705
Ellen Pedersen, Vineland, NJ, 08360
Yonit Yogev, Olympia, WA, 98502
Tess Fraad, New York, NY, 10009
Greg Sweel, Santa Monica, CA, 90405
Kathleen Reynolds, Redmond, WA, 98052
Eileen Juric, Raleigh, NC, 27605
William Snavely, Lawrence, KS, 66049-2579
Eric Aberle, Drexel Hill, PA, 19026
Julia Natvig, Sioux Falls, SD, 57108
Steven Tracy, Gastonia, NC, 28054
Paige Humpston, Lake George, CO, 80827
Dylan Flather, Hamilton, MT, 59840
Deborah Santone, Pleasant Hill, CA, 94523
Ibn-Umar Abbasparker, Fords, NJ, 08863
Linda Petrulias, Cazadero, CA, 95421
Claire Lupton, Whitefield, NH, 03598
Donna Ingenito, Mount Joy, PA, 17552
David Rudin, Colorado Springs, CO, 80904
Sandy Crooms, Valdosta, GA, 31602
Kelley Coleman-Slack, Bellingham, WA, 98229
James Peugh, San Diego, CA, 92106
Donna Bonetti, North Bend, OR, 97459
Linda Rudin, Daly City, CA, 94014
Kat Bowley, Roswell, GA, 30075
Jack Milton, Davis, CA, 95616
cynthia townsend, Portland, OR, 97239
Melanie Murphy, Raleigh, NC, 27610
kathleen dunn, Brooklyn Park, MN, 55445
JOHN HARRIS, Bay Point, CA, 94565
Carol Masuda, Tucson, AZ, 85716
Tanya Milanowski, Balsam Lake, WI, 54810
Dona LaSchiava, Green Valley, AZ, 85614
Martha Horter, Gainesville, FL, 32608
Eric Naji, Marietta, GA, 30060
JANICE PARKER, Toccoa, GA, 30577
Diane Kastel, Wheaton, IL, 60189
Ernest Rodriguez, Laredo, TX, 78045
Rosanne Basu, Hermosa Beach, CA, 90254
R.A.L. West, Taos, NM, 87571
Melanie Marshall, Jacksonville Beach, FL, 32250
Theresa Acerro, Chula Vista, CA, 91911
K Krupinski, Cocoa Beach, FL, 32931
Caryl Pearson, Morro Bay, CA, 93442
Sabrina Hardenbergh, Carbondale, IL, 62902

David Smith, Cathedral City, CA, 92234
Laura Muñoz, , None, 11121
Camille Reinhold, Kirkwood, MO, 63122
Nicole Everling, Eagan, MN, 55122
Gina DiVito, Winfield, IL, 60190
Heather Isaac, Webster, NY, 14580
Claudia Parker, Fort Collins, CO, 80526
Lori Erbs, Acme, WA, 98220
e smith, San Jose, CA, 95123
Kevin Silvey, Seminole, FL, 33777
John Goshorn, Statesboro, GA, 30458
Robert Tyson, Savannah, GA, 31420
john stanton, MacEdon, NY, 14502
Karen Naiman, Denver, CO, 80247
Nancy Earle, Bangor, ME, 04401
Becky Wood, , Dorset, DT11 9JW
Richard Hiscock, Barre, VT, 05641
D. Chalfin, Framingham, MA, 01702
Carol Deem, Lititz, PA, 17543
Mel Eberle, Brecknrdg Hls, MO, 63114
Dawn Taylor, Bristol, VT, 05443
Caroline Mead, Glenview, IL, 60025
Cindy Hatcher, Bumpus Mills, TN, 37028
Catherine Gould, Charlottesville, VA, 22903
Charles Heinrichs, Yreka, CA, 96097
Jane McCullough, Pasadena, CA, 91105
Soraya Barabi, Los Angeles, CA, 90025
Andrea Rugg, Minneapolis, MN, 55419
Andrea Christgau, Keller, TX, 76248
Lisa G, Marlborough, MA, 01752
Laurel Harris, Rutherford, CA, 94573
Julia VandeGrift, Greenfield, WI, 53228
Judy Stewart, Alpharetta, GA, 30022
Cary Harrison, Addison, ME, 04606
Eric Scheihagen, Dallas, TX, 75229
Eric Ross, Sweet Home, OR, 97386
Kathleen SEWRIGHT, Winter Springs, FL, 32708
Leslie Lomas, Boulder, CO, 80303
Stephen Lipman, Bronx, NY, 10471
Connie Arnold, Elk Grove, CA, 95758
Laura Atkinson, Palmyra, VA, 22963
Patricia Dishman, Nashville, TN, 37221
Linda Bell, Santa Rosa, CA, 95403
Ray Grimsinger, Oakland, CA, 94619
Carol Williams, , Gauteng, 15010
James Haig, San Rafael, CA, 94901
Rebecca Shockley, Minneapolis, MN, 55414
Robert Lyons, Dallas, TX, 75206
Tara Kerr, Fayetteville, NC, 28312
Melony Paulson, Diamond Bar, CA, 91765
George Grace, Los Angeles, CA, 90027
Veronica Zecchini, Florence, OR, 97439
Valerie Apple, Los Angeles, CA, 90034
Theresa Lange, Norfolk, NE, 68701
Annika Vonbartheld, Reno, NV, 89509
Florie Rothenberg, Seattle, WA, 98126
Charlotte Bolinger, Grass Valley, CA, 95945
Jeff Kiralis, Fairlee, VT, 05045
Donna Marie Slack, Loveland, CO, 80538
Mary Mann, Roanoke, VA, 24018
Susan Lemont, Arlington, MA, 02476
Scott Smith, Warrenville, IL, 60555
Joan Morgan, Redington Beach, FL, 33708
Catherine Kroeger, Hudson, MA, 01749
Claudia Nichols, Augusta, GA, 30909
Mike Vanlandingham, Shawnee, KS, 66203
Pat Pire, Milwaukee, WI, 53226
Robert Blizard, Springfield, VA, 22151
Ann Schaer, Waldoboro, ME, 04572
Nancy M Francy, Old Bridge, NJ, 08857
Jami Gazerro, Colorado Springs, CO, 80906
Charmaine Hildebrand, Portsmouth, NH, 03801
Inge Knudson, Concord, MA, 01742
Steve-Anna Stephens, Tucson, AZ, 85718
Cheryl Sheldon, Denton, TX, 76207
Amy Tiger, Tulsa, OK, 74115
jean carman, Spokane, WA, 99223
Sandra Wheeler, Farmington, NM, 87401
Connie Howard, Pahrump, NV, 89060
Craig Liggett, Ames, IA, 50010
David Porter, Jackson, WY, 83001
Richard Gallo, Santa Cruz, CA, 95062
Geoffrey Harold, Portland, OR, 97202
Donna Lozano, Harlingen, TX, 78552
Eileen Chieco, Oakland, CA, 94609
Paul Maloney, , , 10001

Kathy Bungarz, Walnut Creek, CA, 94598
val Marshall, Fort Bragg, CA, 95437
Patricia Zeider, Pasadena, CA, 91104
Leslie Phelps, Ithaca, NY, 14850
Ashley Rowley, Grand Junction, CO, 81504
Sierra Sanchez, Seattle, WA, 98125
Sheldon Muller, Denver, CO, 80247
Melissa Rose, Buffalo Grove, IL, 60089
Ally Mora, Panama City, FL, 32404
Sharon Carey, Vancouver, WA, 98683
Debra Dunson, Spring Hill, TN, 37174
Rhonda Zorn, Louisville, KY, 40258
Christine Pikala, Minneapolis, MN, 55401
Bruno DiLeccio, West Chester, PA, 19380
Anandamayi Arnold, Berkeley, CA, 94704
Peter Forsberg, , Stockholm, 12360
Krissa Dutton-Schandelmaier, Anderson, IN, 46013
Alan Lawrence, Portland, OR, 97217
Wrenn Reed, Brookline, MA, 02446
S M, , ON, 90210
Kathleen Medina, Lenox, MA, 01240
Jackie and Fred Duffin, , Dorset, DT6 4HL
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Nancy Manoogian, North Conway, NH, 03860
Jenny Lloyd, Warwick, RI, 02888
Rajni Kurichh, Little Elm, TX, 75068
Tara Ohta, North Hollywood, CA, 91602
Georges Raymond, , CA, 92110
Robert Carey, , ON, K9H 7B2
Marianne Kai, Sherman Oaks, CA, 91403
Maureen Cippel, Haymarket, VA, 20169
Anne Dal Vera, Fort Collins, CO, 80526
Rollin Odell, Kingston, WA, 98346
Laura Salvati, Hernando, MS, 38632
Jeffrey Tanner, Sedona, AZ, 86336
Ellen Phillips, Berkeley, CA, 94704
Kay Reibold, Raleigh, NC, 27606
Alison Van Dusen, Indialantic, FL, 32903
Tara McKenney, Austin, TX, 78745
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Margaret Schulenberg, Round Rock, TX, 78664
Alexander Clayton, Fort Collins, CO, 80524
Susan Nelson Hearon, Woodland Park, CO, 80863
Mikael Estarrona, Cochise, AZ, 85606
Amanda Alcamo, New Hyde Park, NY, 11040
val van dijk, , Friesland, 33131
johan van dijk, Miami, FL, 33131
Adriaan Foppen, , Friesland, 8391 kh
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Doreen Leibowitz, , IL, 44429
Cherine Bauer, Eugene, OR, 97404
sandra arapoudi, , dodecanisos, 85100
Loretta Low, Washoe Valley, NV, 89704
Rebecca Prewitt, North Hollywood, CA, 91602
Patricia Derrough, Mills River, NC, 28759
Matthew Crane, Waimea, HI, 96796
karla Beck, Colleyville, TX, 76034
Zuzanna Wilk, , slaskie, 41600
Lorna Steele, Riverside, RI, 02915
Frances Rove, Leawood, KS, 66206
Christina Di Marco, Hopewell Jct, NY, 12533
Lynn Morgan, Morgan Hill, CA, 95037
Rodney Love, Newbury Park, CA, 91320
Sven Kockro, , AK, 14913
Dale Haas, San Diego, CA, 92115
Robert Snyder, Syracuse, NY, 13212
Diana Wallace MD, Binghamton, NY, 13905
Sue Stoudemire, Atlanta, GA, 30305
megan kress, Olympia, WA, 98502
Drusilla Burrell, Albany, CA, 94706
Renee Barnette, Goodyear, AZ, 85338
Kimber Kaushik, Pearland, TX, 77584
Catherine Lott, Evanston, IL, 60201
Patricia Lasek, Barneveld, NY, 13304
Keely Gililland, Fort Worth, TX, 76108
Craig Christenson, Roseville, MN, 55113
Janet Rountree, Suffolk, VA, 23434
Julie Miller, Monroe, WI, 53566
Laura Kimeu, , NC, 27705
Robin Vosburg, Bakersfield, CA, 93308
Jody Brakeley, Salisbury, VT, 05769
Janice Everett, Knoxville, TN, 37931
Emma Rushton, Nashville, TN, 37212
Lisa Hamilton, Norfolk, CT, 06058

Leah Oviedo, San Diego, CA, 92102
Maureen Edwards, Polson, MT, 59860
christelle whittaker, , , 90005
Elaine Sparrow, Lakewood, CO, 80226
Lara Doornbosch, , , 04707
Jennifer Murray, Saint Louis, MO, 63116
Desiree Girotto, Milford, CT, 06460
Juli Hamilton, Griffith, IN, 46319
Beth Graham, Norfolk, VA, 23503
Anne Mazzone, Easton, CT, 06612
Dianne Anderson, Millcreek, UT, 84124
MICHELLE STEINBRONN, Denver, CO, 80221
May Terry, Portland, CT, 06480
Gretchen Steen, Sandpoint, ID, 83864
Susan Makar, Rockville, MD, 20850
edgar roca, Wellesley, MA, 02482
Kenn Lyon, Concord, CA, 94520
Christina Petridou, , - State -, 01022
Nicolette Noyes, San Francisco, CA, 94110
Mary Murray, Hypoluxo, FL, 33462
L Stephen Bell, Tucson, AZ, 85718
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Kristen Ross, Hedgesville, WV, 25427
Song Hunter, Sacramento, CA, 95822
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clara zahadek, , aquitaine, 24000
Mrs Currah, Casper, WY, 82601
Michael Eichenholtz, Richmond, CA, 94804
Faith Williamson, Eden Prairie, MN, 55344
James Ahearn, Clearwater, FL, 33761
Mike Gonnerman, Spirit Lake, IA, 51360
Sonali Moonesinghe, Sacramento, CA, 95842
Holly Zapf, , , 97212
Tammy Banks, Simsbury, CT, 06070
Audrey Cobrin, Swanton, VT, 05488
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Jenna Krzesicki, Ashford, CT, 06278
Patricia Archuleta, Reno, NV, 89509
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Courtney Worrall, Hampton, VA, 23666
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Sue Crouse, Boulder, CO, 80301
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Jody Moore, N Richland Hills, TX, 76180
Carole O'Connell, Newport, VT, 05855
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deborah alexander, Chatham, NJ, 07928
Cordelia Baethge, , California, 01326
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Genevieve Guzman, Athens, GA, 30606
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Peggy S. Collins, Southfield, MI, 48075
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Trina Warren, Redwood City, CA, 94063
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Barbara Benzwi, Oakland, CA, 94618
Rudy Dankwort, Phoenix, AZ, 85021
Diane-Michele Petrillo, Hamden, CT, 06518
Russell Weisz, Santa Cruz, CA, 95060
Jill Cleveland, Delavan, WI, 53115
Sandra Walters, Enterprise, FL, 32725
Jeannette Welling, Thousand Oaks, CA, 91362
Thomas Slaback, Prescott, AZ, 86303
Juanita Leone, Independence, MO, 64055
Bryan Wyberg, Saint Paul, MN, 55113
Michelle Guthrie, Portland, OR, 97202
Paula Shafransky, Sedro Woolley, WA, 98284
Karen Hunter, North Barrington, IL, 60010
Sammy Chandhok, Middleton, WI, 53562
Joseph Hayes, Grand Junction, CO, 81503
Laurie Winogrand, Las Vegas, NV, 89118
Paul Brown, Pittsburgh, PA, 15238
David Aylward, Asheville, NC, 28806
Laurie Fisher, Tigard, OR, 97224
Lorraine Lowry, Vacaville, CA, 95688
Andrea Storrs, Woodland Park, CO, 80866
Susan Connor, Philadelphia, PA, 19123
Saskia Santos, Columbia, SC, 29209
Jennifer Cunningham, Bolingbrook, IL, 60440
Frank Ayers, Altoona, PA, 16602
Jerry Melton, Corvallis, OR, 97330
Patty Linder, San Jose, CA, 95136
Teresa Mynko, Lake Elsinore, CA, 92530
Dennis Yee, Scottsdale, AZ, 85250
katherine stewart, Northbrook, IL, 60062
Judith Smith, Oakland, CA, 94601
Bruce Cratty, Akron, OH, 44313
Sharon Frank, Lewisville, TX, 75077

Cathryn Bulicek, Lincolnwood, IL, 60712
Geraldine Card, Exeter, CA, 93221
Susan Foley, Westfield, MA, 01085
Laura Bruess, Boulder, CO, 80304
Kevin Gallagher, Lake Forest Park, WA, 98155
Tanya Saltau, Landsborough, Qld, 04550
Charles Wolfe, Sylmar, CA, 91342-1401
Valerie Dorn, Mount Laurel, NJ, 08054
Sharon McDonough-Means, Tucson, AZ, 85701
William Thornton, Tucson, AZ, 85716
Susan Brandes, Tucson, AZ, 85716
Rita Meuer, Madison, WI, 53704
Gary Goetz, Pacific Grove, CA, 93950
Cheryl Rigby, Ashland, MA, 01721
Paul Hunrichs, Santee, CA, 92071
Joanne Conti, Richmond, MA, 01254
Mario Guzman, San Jose, CA, 95112
Carolyn Riddle, Vancouver, WA, 98685
R. Zierikzee, San Francisco, CA, 94118
Suzy Lawrence, Chapel Hill, NC, 27516
Linda Morgan, San Pablo, CA, 94806
Sarah Diehl, Pacific Grove, CA, 93950
Kara Pate, Boise, ID, 83706
Joseph Marsala, Jber, AK, 99506
Sara E Eldridge, Seattle, WA, 98115
Emily Spence, North Oxford, MA, 01537
Frank Blake, Houston, TX, 77006
Carole Kramer, Hollis, NY, 11423
Vic Burton, Kansas City, MO, 64113
John Sullivan, Tucson, AZ, 85750
Maria Nasif, Tucson, AZ, 85718
Kristin Vyhnal, Albuquerque, NM, 87122
Emily Bayer, Fort Wayne, IN, 46802
Bethan carter, Anchorage, AK, 99516
Ellen Shively, San Diego, CA, 92139
Edward Reichman, West Orange, NJ, 07052
Rose Shulman, Traphill, NC, 28685
Art Glick, Renick, WV, 24966
Barbara Bingham, Phoenix, AZ, 85044
Faith Willcox, Bremen, ME, 04551
Joe Toigo, Godfrey, IL, 62035
Pamela Dilley, East Lansing, MI, 48823
Kathleen O'Connell, Indianapolis, IN, 46227
Tom Brown, Woodstock, VT, 05091
Uphoria Blackham, Albuquerque, NM, 87112
Michelle Talhami, Shorewood, WI, 53211
Mark Canright, Asbury, NJ, 08802
Larry Olson, Montpelier, VA, 23192
James Roberts, Sandpoint, ID, 83864
Diana Greenhalgh, New Milton, WV, 26411
Judith Newman, Ferndale, WA, 98248
Tom Angelakos, Chicago, IL, 60657
Alexandra Samaras, Rockland, ME, 04841
Maria Theresa Hebron, Fredericksburg, VA, 22401
Kaiba White, Austin, TX, 78741
Frances Dunham, Ashland, OR, 97520
Shannon Marshall, Baltimore, MD, 21214
Cindy Stein, Newbury Park, CA, 91320
sheryl gillespie, Denver, CO, 80209
Edward Zukoski, Boulder, CO, 80305
Brandi McCauley, Des Moines, IA, 50312
Laura Huddlestone, Seattle, WA, 98106
Chris Tumolo, Danielson, CT, 06239
Tracey Laszloffy, Wilmington, NC, 28412
LeeAllen Meyer, Winthrop, MA, 02152
Leo Shapiro, College Park, MD, 20740
Tracy Ouellette, Bow, WA, 98232
Leigh Begalske, Green Bay, WI, 54302
Rita Falsetto, Walsenburg, CO, 81089
James Provenzano, Valley Center, CA, 92082
David Broadwater, Atascadero, CA, 93422
James Patton, Los Altos, CA, 94024
Rebecca Summer, Silver City, NM, 88061
John Sutherland, White Hall, AR, 71602
Joanna Vintilla, Seattle, WA, 98133
george patterson, Philadelphia, PA, 19144
Ann Bein, Los Angeles, CA, 90064
Jenna Allen, Bedford, OH, 44146
Bonnie Maller, Newburyport, MA, 01950
Susan Welch, Marion, IL, 62959
Suzanne Barns, Batesburg, SC, 29006
MaryAnna Foskett, Arlington, MA, 02476
Claire Perricelli, Eureka, CA, 95501
Benjamin Henderson, New York, NY, 10019
Eric Brooker, Charleston, SC, 29492
Mark Mansfield, Geneva, NY, 14456

Jean Marwick, Peekskill, NY, 10566
Tina Tine', Kingston Springs, TN, 37082
Jennifer Waldo Gaffney, Las Vegas, NV, 89166
Timothy Edward Duda, San Antonio, TX, 78209
Jana Harker, Arcadia, CA, 91066
Carolyn Warner, Saint Petersburg, FL, 33704
Susan Blain, San Diego, CA, 92104
Linda Bescript, Langhorne, PA, 19047
Kira Durbin, Sherman Oaks, CA, 91411
Penny Birch-Williams, Clearwater, FL, 33763
Mark Reback, Camas, WA, 98607
Scott Ploger, Idaho Falls, ID, 83401
Diane Reaver, Blacksburg, VA, 24060
Pat Mace, Spotsylvania, VA, 22553
Nancy Fleming, Lake Oswego, OR, 97034
Leila Mohseni, Boulder, CO, 80302
Gina Cashier, La Fayette, NY, 13084
Sally Hammond, Tucson, AZ, 85741
Marci Moss, Gurnee, IL, 60031
Jenifer Johnson, Marietta, GA, 30062
Cinda Johansen, , , 95630
Candace Rocha, Los Angeles, CA, 90032
Sophia Vassilakidis, Houston, TX, 77057
Sherry Massie, Tucson, AZ, 85748
Beth Richman, Sebastopol, CA, 95473
Victoria Obrien, Ridgewood, NY, 11385
Laura Waterworth, Aurora, CO, 80013
David Burtis, Calistoga, CA, 94515
Vanassa Lundheim, Everett, WA, 98203
Mary Ann Baier, Dearborn, MI, 48124
DAVID BRADBURY, Santa Fe, NM, 87501
Daniel Villaume, Berkeley, CA, 94709
Cassandra Tereschak, Scranton, PA, 18510
Aleda Richardson, West Des Moines, IA, 50266
Amy Schumacher, Beavercreek, OH, 45440
Susan Ambler, Denver, CO, 80206
Patricia Brech, Elkton, MD, 21921
Joanne Barnes, Palo Alto, CA, 94306
Jacqueline Carroll, Paso Robles, CA, 93446
Devon Seltzer, High Point, NC, 27260
Jody Gibson, Des Moines, IA, 50315
Nancy Hemberger, Reading, PA, 19606
Susan Lefler, Livingston, TX, 77399
Janice Higgins, Hadley, MA, 01035
Dara Gorelick, Van Nuys, CA, 91406
Catherine Williams, Tucson, AZ, 85719
lonna richmond, Muir Beach, CA, 94965
Susan Gardner, Independence, MO, 64055
marjorie angelo, Bunnell, FL, 32110
Michelle Palladine, Palm Springs, CA, 92262
Sarah Weekley, Dayton, OH, 45439
Betty Kissilove, San Francisco, CA, 94122
Thomasine Montoya, Rio Rancho, NM, 87124
Denise Lytle, Woodbridge, NJ, 07095
Mark Stannard, Los Angeles, CA, 90056
Patricia PERRON, Seattle, WA, 98117
Jodie Zupancic, Flushing, NY, 11355
Heather Tachna, Colorado Springs, CO, 80919
Barb Morrison, Clearwater, FL, 33764
Annalee Pineda, San Francisco, CA, 94109
Donna Panza, Grass Valley, CA, 95949
Anthony Donnici, Liberty, MO, 64068
Sonia King, Soquel, CA, 95073
Kathryn Fox, Salem, OR, 97317
JL Burns, Osawatomie, KS, 66064
Florence Sandok, Viroqua, WI, 54665
Janet Delaney, Austin, TX, 78731
John Teevan, Chula Vista, CA, 91914
Marco Pardi, Lawrenceville, GA, 30043
Celinda Risvold, Naperville, IL, 60540
Diane Cantwell, Tujunga, CA, 91042
Nancy Hubbs-Chang, Pasadena, CA, 91105
Mark Skevofilax, Dallas, PA, 18612
Leslie Evelo, Cincinnati, OH, 45211
Joe Glaston, Desert Hot Springs, CA, 92240
Constance Charles, Santee, CA, 92071
Niall Carroll, Astoria, OR, 97103
Jennifer Nitz, Missoula, MT, 59802
Gloria Shen, Asheville, NC, 28805
Justin Chernow, Paso Robles, CA, 93446
Duane Greene, Rego Park, NY, 11374
Julie Moylan, Tacoma, WA, 98402
Pamela Miller, Tolar, TX, 76476
Katherine O'Sullivan, New York, NY, 10034
Richard Riggs, Branchburg, NJ, 08876
Elsy Shallman, Loxahatchee, FL, 33470

Donald Schwartz, Baltimore, MD, 21209
Laura Herndon, Burbank, CA, 91505
Dana Gatto, Oakland, CA, 94608
Jameson Bergen, East Haddam, CT, 06423
Ronda Reynolds, Columbia, SC, 29229
Paul Sauk, West Grove, PA, 19390
Henry Berkowitz, Sabinsville, PA, 16943
Alan Wojtalik, Baltimore, MD, 21234
Gordon Smith, Brunswick, ME, 04011
Natalie DeBoer, Richmond, VA, 23229
Denise Neuzil, Green Valley, AZ, 85614
Michelle Macy, Houston, TX, 77077
benedetto salamone, Burlington, MA, 01803
Terri Saurs, Decatur, IL, 62521
Rosamund Downing, Pawcatuck, CT, 06379
Sabrina Eckles, Lubbock, TX, 79416
Dan Morgan, Lynnwood, WA, 98036
Edwin Aiken, Sunnyvale, CA, 94087
Janet Thew, Flat Rock, NC, 28731
Kerrie Shisila, Parma, OH, 44134
Craig Bunting, Eddyville, KY, 42038
Jo Feyhl, Lebanon, NH, 03766
gwen hawtof, Traverse City, MI, 49684
Bonnie Beach, Montrose, CO, 00000
Pamela Hamilton, Fort Worth, TX, 76131
Marsha Ross, Palm Harbor, FL, 34683
nathan schaefer, Antrim, NH, 03440
Pete Klosterman, New York, NY, 10025
Sarah Stewart, Watertown, MA, 02472
Richard Spotts, Saint George, UT, 84790
Christine Ney, Anaheim, CA, 92807
Alicia Salazar, Los Angeles, CA, 90032
Erin Garcia, Los Angeles, CA, 90025
Laurel Dorr, Atlanta, GA, 30307
Lisa Goodrich, Boulder, CO, 80302
Joseph Folino Gallo, , , 15108
Nicholas Esser, Simi Valley, CA, 93065
Adam Pastula, Boulder, CO, 80301
Kara Harms, Bothell, WA, 98012
Michael Harmon, Lafayette, IN, 47905
Paul Moss, White Bear Lake, MN, 55110
Sammy Low, Stanwood, WA, 98292
Edward Zepeda, Bisbee, AZ, 85603
Lauri Moon, Williamsport, PA, 17701
Mike Marvet, Knoxville, TN, 37912
Martha Vest, Portland, OR, 97222
Anne Jameson, Marshfield, VT, 05658
Perry Chapdelaine, Ashland City, TN, 37015
Palmeta Baier, Kirksville, MO, 63501
Suzannah Smith, Franklin, TN, 37064
Catherine Grady, Bois D Arc, MO, 65612
Cara Stiles, Boulder, CO, 80301
Donna Thomas, Yucca Valley, CA, 92284
Scott Warwick, Altadena, CA, 91001
Vikram Sikand, Weehawken, NJ, 07086
Marlene Schwarz, Auburndale, MA, 02466
Carol Hall, Fairfax, VA, 22033
Carl Pribanic, Frisco, TX, 75036
Jane Rosen, New York, NY, 10011
Magali Lequient, Park City, UT, 84098
Nancy J Stevenson, Shoreview, MN, 55126
Elizabeth Enright, Scottsdale, AZ, 85251
Susan Lohrey, Alexandria, KY, 41001
Constantina Hanse, Pittsburgh, PA, 15218
Beverly Ann Conroy, Fish Creek, WI, 54212
Randi Field, Silver Spring, MD, 20901
Alice Polesky Polesky, San Francisco, CA, 94107
Sherry Frey, Douglassville, PA, 19518
Rachael Denny, Bradley, CA, 93426
Aubrey Johnson, Pascagoula, MS, 39567
judy mickey, Naples, FL, 34109
Gerald Hallead, Traverse City, MI, 49684
Susan Dickerson, Clinton, MD, 20735-1542
Maria de la Rosa-Young, Evanston, IL, 60202
Josh Guy, Grand Ledge, MI, 48837
Brent Naylor, Raymond, WA, 98577
Richard Longley, Fort White, FL, 32038
K L, Roseburg, OR, 97470
Martin Tripp, Santa Clarita, CA, 91390
Dat Tran, Upper Darby, PA, 19082
Gay Goden, Euclid, OH, 44119
AIMEE MILLENSIFER, Denver, CO, 80231
Nan Singh-Bowman, Ben Lomond, CA, 95005
Susan Hanlon, Manchester, NJ, 08759
Bonnie Mandel, North Myrtle Beach, SC, 29582
Louis Fischer, Washington, DC, 20015

Patricia Coghlan, Tucson, AZ, 85748
maria Nazzaro, Portland, OR, 97211
Vicki Faeo, Belfry, MT, 59008
Susan Wallace, Cameron Park, CA, 95682
Torunn Sivesind, Roseville, CA, 95678
Amy Tajdari, Jacksonville, FL, 32224
Fred Stanback, Salisbury, NC, 28144
Bobbie Hensley, Greeneville, TN, 37743
Edward Butler, New York, NY, 10021
Roz Rogers, Deerfield, NH, 03037
Birgit Hermann, San Francisco, CA, 94117
linda faso, Las Vegas, NV, 89113
Jamie Green, Ventura, CA, 93004
Carol Carson, Norwalk, CT, 06851
Tamara Reed, Phoenix, AZ, 85018
john margerum, Philadelphia, PA, 19129
Mary Wiener, Carpinteria, CA, 93013
Susan Beil, Camarillo, CA, 93012
Cleo Reilly, Portland, OR, 97229
Todd Clark, Indianapolis, IN, 46219
Kenny Bowman, Orlando, FL, 32817
Jenna Fallaw, Bozeman, MT, 59715
Danielle Barcilon, Miami, FL, 33133
Robin Hamlin, McKinleyville, CA, 95519
Valerie Shideler, Olivehurst, CA, 95961
Linda Jung, Harlem, GA, 30814
Hashi Hanta, Sells, AZ, 85634
Neal Steiner, Los Angeles, CA, 90034
Joseph Quirk, New York, NY, 10009
Charles Cohen, Huntsville, AL, 35806
Katherine Gould-Martin, Cliff, NM, 88028
Roberta Weissglass, Santa Barbara, CA, 93160
Mary TRUE, Pepeekeo, HI, 96783
Fran Pletschet, Sun City West, AZ, 85375
Elizabeth Clapp, Vallejo, CA, 94589
Scott Wynn, Kingsport, TN, 37664
Robin Patten, Del City, OK, 73115
Karen Linn, Delaware, OH, 43015
Michele Veiga, Hamden, CT, 06518
June Campbell, Tucson, AZ, 85733
Heath Hancock, Atkinson, IL, 61235
Jo Ann Johnson, Dewey, AZ, 86327
Laurence Skirvin, Villa Rica, GA, 30180
William Grosh, El Centro, CA, 92243
Peter Reagel, Burien, WA, 98148
Mary Keithler, Englewood, CO, 80111
Wilma Polk, Salisbury, MD, 21804
Mary Stanton, Oak Park, IL, 60302
Bruce Cutts, Greeley, CO, 80634
Bruce Troutman, Key West, FL, 33040
Jane Broendel, Washington, DC, 20015
Mary Bailey, Southington, OH, 44470
Don Bergey, Winston Salem, NC, 27106
Debi Combs, Decatur, GA, 30033
John Lorand, Mount Pleasant, MI, 48858
Anina Carr, Sandisfield, MA, 01255
Kermit Cuff, Mountain View, CA, 94041
Rebecca Clark, Portland, OR, 97203
Cornelia Herschel, Borkum, Niedersachsen, 26757
David Rosenfeld, Brooklyn, NY, 11230
Alison F., , ON, K0L2Y0
Sharon Mcgregor, , Scotland, Ne24 4lh
Janel Fraser, , , B2H 5C4
Bonnie Sonnenschein, , QC, H3k 0A2
Christopher Pond, Roseburg, OR, 97471
Debra Brinker, Dublin, OH, 43017
Mechelle Hannahs, Tacoma, WA, 98446
Mary Ann Viveros, Mayfield Hts, OH, 44124
Mary Franz, Laguna Beach, CA, 92651
Jacqueline Wood, , , K1M 2A6
Lynn Pique, Redwood City, CA, 94063
Marie-Eve Tremblay, , QC, J3H 3E7
Debra Hand, Hobe Sound, FL, 33455
Brigitte Roy, , , T
April Wheeler, San Diego, CA, 92117
Karoline Pletzer, , Tirol, 06406
Van Knox, Lititz, PA, 17543
Maria Sacristan, , Madrid, 28011
Kelly Kreiser, Dade City, FL, 33523
Kari Rust, Vancouver, BC, V6K4A1
Anja Phenix, Healy, AK, 99743
Patricia Maddalena, , ON, L2R6P7
Regine Neulen, , NRW, 51069
Rachel James, , , Ba11 3ap
Michael Bechard, Houston, TX, 77027
Maryann Staron, Hometown, IL, 60456

Elizabeth O'Nan, Chapel Hill, NC, 27517
Elizabeth Brown, Waldwick, NJ, 07463
Jemma Boshoff, , Kwa Zulu Natal, 03610
Rebecca Cliff, , Fife, KY11 2YP
Sara Ellisson, New York, NY, 10029
Rob Lozon, Flint, MI, 48507
Margaret Guilfoy Tyler, Saint Louis, MO, 63122
Brittany Freeman, , , T5y 0j6
Judy Moran, Panama City, FL, 32404
Carol Pryce, , ON, L1Z1N2
JASON NAKAGAWA, Los Angeles, CA, 90066
Aaron Kenna, La Mesa, CA, 91942
Dannette Bowers, Canton, OH, 44706
Rolf Jander, Surrey, BC, V3R7W7
Eileen Melia-Chiappetta, , ON, L4S0A4
Josefa Clemente, Lilburn, GA, 30047
William Kelley, Nokomis, FL, 34275
Sharon Wootton, Hereford, AZ, 85615
Nora Gaines, New York, NY, 10024
Esther Weaver, Highland, NY, 12528
George Pappas, Chicago, IL, 60618
Dori BAILEY, Chimacum, WA, 98325
Beth Darlington, Poughkeepsie, NY, 12604
Maynard Jerome, Channahon, IL, 60410
Wayne Harris, Bradenton, FL, 34203
Lawrence Mick, Dayton, OH, 45449
Haven Knight, Rochester, MI, 48306
Susan Saltzman, Philadelphia, PA, 19102
Dave Griswold, Ft Lauderdale, FL, 33315
Linda Butler, Punta Gorda, FL, 33983
Mary Tullock, Rohnert Park, CA, 94928
Benoit Braconnier, , AL, 33200
WILLIAM RYERSON, Indianapolis, IN, 46228
Patty Ridenour, Oakwood, OH, 45419
Ryan Davis, Burbank, CA, 91502
Brent Rocks, Portland, OR, 97201
Christy DuCharme, Cottonwood, AZ, 86326
Darrell Neft, Costa Mesa, CA, 92626
Jacqueline Knable, Hendersonville, NC, 28791
Martha Price, Sanibel, FL, 33957
Eric Crouch, Ames, IA, 50014
Rita Garvey, Clearwater, FL, 33756
janna piper, Portland, OR, 97293
Stan Fitzgerald, Walnut Creek, CA, 94595
Steve Berman, Fresno, CA, 93703
Gloria Fooks, Saint Clair, MO, 63077
Suzanne Schaem, New York, NY, 10022
Deric McGee, Alameda, CA, 94501
Mitchell Shea, Great Barrington, MA, 01230
Meg Gilman, Portsmouth, NH, 03802
Ellen Davis, Los Angeles, CA, 90025
marilyn ACTION ALERT brenneman, Colorado Springs, CO, 8090
Anil Prabhakar, Cedar Park, TX, 78613
Lauren Stone, Onset, MA, 02558
Maryanne Jerome, Boulder, CO, 80302
Elaine Embrey, Bellvue, CO, 80512
M Child, Richmond, CA, 94804
Stanley Naimon, Midlothian, VA, 23114
Dwight Sanders, Rochester, MI, 48306
Kenneth Hyche, Cullman, AL, 35057
t bell, Howell, NJ, 07731
William Smart, Dothan, AL, 36301
Rev. John Fernandes, San Leandro, CA, 94577
mark youd, Ormond Beach, FL, 32174
Lucy Henderson, Orinda, CA, 94563
Alan Papscun, Stockbridge, MA, 01262
Mark Grzegorzewski, St Petersburg, FL, 33702
Cynthia McNamara, Albuquerque, NM, 87125
Jeffrey Hurwitz, San Francisco, CA, 94121
Heidi Behnke, Spring Valley, CA, 91977
Char Esser, Bryn Mawr, PA, 19010
John Hennessy, Edmonds, WA, 98026
mj Najimi, Plano, TX, 75093
Jusef White, Hoopa, CA, 95546
Wayne Miller, Falkville, AL, 35622
Robert Stewart, New York, NY, 10011
Liz Fife, Washington, DC, 20009
William Cline, Ottawa Hills, OH, 43606
Carole Scott, Saint Louis, MO, 63130
Tracy Cole, Glendale, AZ, 85302
michael klein, Akron, OH, 44303
Valerie Sanfilippo, San Diego, CA, 92111
marilyn dougher, Anchorage, AK, 99502
Dawn Foster, Placitas, NM, 87043
Ian Brown, , CT, 00000
Susan Edelstein, Cary, NC, 27511

Diana Praus, Albany, NY, 12204
Judith Cherry, Austin, TX, 78737
Jackie Stolfi, Massapequa Park, NY, 11762
Fawn King, Pennington, NJ, 08534
Joe Nichols, Snohomish, WA, 98290
Paul Bechtel, Redlands, CA, 92373
Mary McMahon, Philadelphia, PA, 19111
Donald Walsh, Alexandria, VA, 22314
Lenny Cavallaro, Methuen, MA, 01844
Joan Lewis, Castro Valley, CA, 94552
Diane Goldberg, Port Saint Lucie, FL, 34986
Sheila Erlbaum, Philadelphia, PA, 19119
Judith Stone, Kent, WA, 98032
Dahlia Rudavsky, Templeton, MA, 01468
Lauren Fenenbock, El Paso, TX, 79902
Stephen Boletchek, Apex, NC, 27502
Yvette Goot, Colville, WA, 99114
Emily Johnson, Springville, IA, 52336
David Bryan, Lewes, DE, 19958
Jeanine Yows, Salem, OR, 97302
Amanda Hauck, Springfield, OH, 45504
Beverly Antonio, Centreville, MD, 21617
Ken Canty, Dudley, MA, 01571
Susan Faust, Primos, PA, 19018
Anne Hepfer, Seattle, WA, 98101
Sarah Adrian, Lathrup Village, MI, 48076
Susan Siniard, New Market, AL, 35761
jay van, Danville, CA, 94506
Edward Rengers, Woodstock, NY, 12498
Ken Maurice, Anchorage, AK, 99501
Paula Bushkoff, Princeton, NJ, 08540
Pamela Green, Napa, CA, 94558
Glen Hampton, Saint Ignace, MI, 49781
Marilyn Maurer, Wynnewood, PA, 19096
Jeff Kronick, Lake Orion, MI, 48361
Sally Fitz, Tulsa, OK, 74137
Bernadette Webster, Whitethorn, CA, 95589
Jennifer Gitschier, Leicester, MA, 01524
John Simanton, Spokane, WA, 99204
Alexandra Hopkins, La Crescenta, CA, 91214
Elizabeth Ketz-Robinson, Alexandria, VA, 22308
Robin Jenkins, Dallas, OR, 97338
Daniel O'Brien, Milton, NY, 12547
Debbie McKevitt, Lagrange, GA, 30241
Marge W Barry, Nampa, ID, 83686
Danah Woodruff, San Diego, CA, 92117
Sherry Black, Thornton, CO, 80233
Matthew Reid, Calistoga, CA, 94515
Benjamin Schlau, Los Angeles, CA, 90026
Alexander Fierro-Clarke, Los Angeles, CA, 90026
Jim Sheridan, Honeoye Falls, NY, 14472
Herschel Flowers, Kansas City, MO, 64152
Nancy Orr, Moab, UT, 84532
Brenda Hogan, East Providence, RI, 02914
Deborah Gervais, , ON, K0A2T0
H Baum, Pinckney, MI, 48169
John Fernandes, San Leandro, CA, 94577
PJ Anderson, Saline, MI, 48176
Hayden Reiter, Ellicott City, MD, 21042
Natalia Vann, Methuen, MA, 01844
Kim Yirak, Poway, CA, 92064
Megan Baker, Thornton, CO, 80229
J.L. Evans, Compton, AR, 72624
Karen Suit, Falling Waters, WV, 25419
Nanna Hamfler, , HE, 61184
Kathi Ward, St Petersburg, FL, 33704
Mel Hunt, Nashville, IN, 47448
Harlan Smith, Huntington, WV, 25701
Michael Weaver, Saint Charles, IL, 60174
Carla Williams, Cottage Grove, OR, 97424
Thomas Yentsch, Cambridge, MN, 55008
Laurie Alstrom, Manchester Township, NJ, 08759
Christina Clement, Intercourse, PA, 17534
Rod Stokes, Valrico, FL, 33596
cb michaels, Mantua, NJ, 08051
Peter Nelson, Eau Claire, WI, 54701
Klaudia Englund, Anacortes, WA, 98221
Emma Tresemer, Hood River, OR, 97031
Hons. Jim and Diana Prola, San Leandro, CA, 94577
Diana DillonSmith, Derry, PA, 15627
Laurie Bentley, Mountain Home, ID, 83647
Nicole Rojas, Willow Springs, IL, 60480
Allison Judd, Saint Cloud, MN, 56303
Stephanie Kaylan, Tijeras, NM, 87059
Joanne Kendrick, Plano, TX, 75024
Andrea Dixon, Pinon Hills, CA, 92372

Sharon Hotham, Phoenix, AZ, 85022
John Crawford, Middletown, CT, 06457
Joseph White, Cool, CA, 95614
Laura Chinofsky, Southampton, PA, 18966
tami schreurs, Boynton Beach, FL, 33472
Lisa Konrad, Rockville Centre, NY, 11570
Michael Quinn, , state, BD16 1QF
Linda Easley, Albuquerque, NM, 87120
Holly Asamura, Oceanside, CA, 92057
Derek Carpenter, Centennial, CO, 80016
David Baine, Federal Way, WA, 98023
Gary Allen, Beverly Hills, CA, 90211
Walt Bellhaven, Beverly Hills, CA, 90211
Cynthia Allen, Lawrenceville, GA, 30043
Daniel and Denise Martini, Las Vegas, NV, 89183
Nan Paisley-Brunskill, Liberty Twp, OH, 45011
MICHELE CASTANO, Brentwood, CA, 94513
Carol Hayford, Bloomfield Hills, MI, 48302
Debbie mannion, Chesterfield, MO, 63005
Kelly Berry, San Rafael, CA, 94903
Noah Haydon, Daly City, CA, 94015
Kathleen Knoeppel, Hartland, WI, 53029
Maria Humbert, Shelton, CT, 06484
Martha Sharkin, Lakewood, OH, 44107
Anne Wishart Arnold-Ratliff, Cynthiana, KY, 41031
Victoria Brislin, Ironton, OH, 45638
Mark Kern, Nokomis, FL, 34275
Anne V Orth, Gerald, MO, 63037
Diane Wallace, Kernersville, NC, 27284
Debra Owen, Scottsdale, AZ, 85251
Gail Ward, Saint Paul, MN, 55116
Kristy Kirkland, Farmerville, LA, 71241
Carole Ackelson, Erie, PA, 16510
Marian Ryan, Winter Haven, FL, 33880
Alison Glennon, San Diego, CA, 92107
Judy Stewart, Westford, MA, 01886
Michael Richmond, Intercession City, FL, 33848
Leslie Billings, Wallingford, CT, 06492
Pat Rose, Skokie, IL, 60077
Jay Treat, Denver, CO, 80216
Kelsey Brodt, Coon Rapids, MN, 55448
Barbara Peachee, Alvaton, KY, 42122
Stephanie Gutierrez, Oklahoma City, OK, 73120
Tricia Lisa, Islip, NY, 11751
Merry Parsons, Woodland Park, CO, 80863
Kathryn St. John, Boulder Creek, CA, 95006
Catherine Perman, Palo Alto, CA, 94301
Stefan Hadfield, , Waikato, 03216
Brandon Lowentrout, Westminster, CA, 92683
Amanda Real, Rockford, IL, 61109
Maria Dimauro, Bristol, CT, 06010
Christina Walsh-Curley, Auburn, CA, 95603
Hilary Jesmer, Hugo, MN, 55038
Rachel Lindsey, Chicago, IL, 60619
Robin Bauer, , Baden-Wuerttemberg, 70567
M Rasmussen, Pensacola, FL, 32504
Anthony Scrimenti, Albany, NY, 12205
Ines Adriaens, , État / Province..., 01050
Jeremy Riedel, Cleveland, OH, 44118
Rina Sunar, Lititz, PA, 17543
Eric Murrock, Sturgeon Bay, WI, 54235
Chloe Key, Tukwila, WA, 98168
Ewelina Klimek, Hopewell Junction, NY, 12533
Susan Worden, Rio Vista, CA, 94571
Krista Johnson, Wayzata, MN, 55391
Penny Redmond, Olympia, WA, 98502
priscilla martinez, Snoqualmie, WA, 98065
Ryan Baka, Minneapolis, MN, 55411
Jana Harter, Canyon Lake, TX, 78133
caru epstien, Carnegie, PA, 15106
Adam Pietrangelo, Kalamazoo, MI, 49008
Jill Robison, , , 77077
David Mazariegos, Folsom, CA, 95630
Em Tweed, Erie, PA, 16506
Joseph McDonough, Hemet, CA, 92544
Nikki Bango, Columbus, OH, 43207
Tina Eldred, , Cornwall, TR27 5DA
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CHRISTOPHER HARRIS, Shelbyville, MI, 49344
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Geraldine Ferrara, Hastings On Hudson, NY, 10706
Mike Camp, Lodi, CA, 95240
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Baysan Tulu, Holland, MI, 49423
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Barbara Barski, , Niedersachsen, 33739
Lisa Cardon, Phillipsburg, NJ, 08865
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Serena Donnelly, Camas, WA, 98607
Lerene Ahart, Austin, TX, 78739
Debbie Martinez, Reno, NV, 89521
Wes Weaver, Boone, NC, 28607
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Justin Kreiser, Dade City, FL, 33523
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Petra Albrechtova, Jasper, AB, T0E1E0
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James Roberts, Dallas, TX, 75205
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Carol Hill, Spartanburg, SC, 29301
Ryan Dell, Santa Rosa, CA, 95405
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Sarah Walsh, St. John's, NL, A1B 5E3
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Oxana Postnaya, Windermere, FL, 34786
Julie Tanner, New York, NY, 10033
d r, Endicott, NY, 13760
John Walton, Gualala, CA, 95445
Linda Martin, El Cajon, CA, 92021
Thomas Cope, Medina, OH, 44256
Carlos Nunez, Reseda, CA, 91335
Jerrilynne Titsworth, Sarasota, FL, 34237
Diane Pierce, Ames, IA, 50014
Margret Cifaldi, Las Vegas, NV, 89147
Armando A. Garcia, Perris, CA, 92571
Dustin Lecander, Minneapolis, MN, 55417
Lisa Johnson, San Antonio, TX, 78240
Allen Altman, Great Barrington, MA, 01230
Duane Head, Bessemer, AL, 35023
Barbara Burton, Memphis, TN, 38111
Michael Hinshaw, Inkster, MI, 48141
Kevin Milam, Seattle, WA, 98117
Marsha Lyon, San Diego, CA, 92116
James Keenan, Lansdowne, PA, 19050
Julia Bottom, Longmont, CO, 80503
Elizabeth Moore, Gaithersburg, MD, 20877
Barbara Youngquist, Evanston, IL, 60203
Michael Denton, San Leandro, CA, 94578
Rachel Dobbs, Memphis, TN, 38104
Joan Beer, Jackson, MI, 49203
Natalie Blasco, Anderson, CA, 96007
Lawrence Deng, San Jose, CA, 95120
B. Z., Mary Esther, FL, 32569
Terri Melville, Boulder, CO, 80303
Larry Fish, Niland, CA, 92257
Theresa Bucher, Tarzana, CA, 91356
frances consalvo, Franklin, TN, 37064
Edward Handley, Louisville, KY, 40241
Barbara Baird, Rayland, OH, 43943
Douglas Estes, Lakewood, OH, 44107
Saundra Petrella, Beaver, PA, 15009
John Friestad, Conway, SC, 29526
Raymond Intemann, Cliffside Park, NJ, 07010
Andrew Stutt, , ON, K2H 9M8
Noah Hanmer, Bristol, RI, 02809
Tracy S Troth, Pearl, MS, 39208
Geoff Gahm, Eureka, CA, 95501
Holly Stuart, Salt Lake City, UT, 84102
Emma Compton, Broomall, PA, 19008
Rosemary DeFlorio, River Vale, NJ, 07675
Mary Girard, Dearborn Heights, MI, 48125
Kathleen Johnson, Salem, OR, 97302
Leo Vollenbroek, , Overijssel, 81111
Joan Griffin, Nevada City, CA, 95959
terrill maguire, Eureka, CA, 95501

Penelope Andrews, Hermon, ME, 04401
Douglas Renick, Florence, MA, 01062
N D, New York, NY, 10075
David Osterhoudt, Rancho Santa Margarita, CA, 92688
Victoria Shih, Plano, TX, 75025
Betty Ann Duggan, Princeton, NJ, 08540
Kara Huberman, Brooklyn, NY, 11230
Alfred Ferraris, Port Townsend, WA, 98368
mukund sharma, , new delhi, 110029
Ray Hearne, Stockton Springs, ME, 04981
Mary Ann Toal, Bradenton, FL, 34202
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Holli Cook, Peoria, IL, 61603
Virginia Brace, Frederick, MD, 21702
Mary Ann Tober, Lancaster, NY, 14086
Hunter Wallof, Soulsbyville, CA, 95372
Kate Kelley, Ocala, FL, 34482
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Tonya Morrison, Normandy, TN, 37360
Brandon Schwartz, New York, NY, 10280
Philip Ritter, Surprise, AZ, 85388
Jim Woolly, Little Rock, AR, 72227
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Mary Rao, Calhoun, GA, 30701
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Tiffany Buell, Cudahy, WI, 53110
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Mary Troland, Oceanside, NY, 11572
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Jennifer Lane, Germanton, NC, 27019
Harriet Cohen, New York, NY, 10016
Kathleen Mallory, Salt Lake City, UT, 84105
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Forest Shomer, Port Townsend, WA, 98368
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Gail Papa, Rochester, NY, 14624
Candice Schellenger, Reno, NV, 89523
Stephen Rauworth, Cortez, CO, 81321
Freya Goldstein, New York, NY, 10025
Wesley Banks, Vancouver, WA, 98682
Janell Smith, Bradenton, FL, 34205
Priscilla Wright, Littleton, CO, 80128
Jaye Trottier, Bedford, NH, 03110
Kathleen Dolson, Saint Louis, MO, 63121
Richard Bold, Vista, CA, 92084
Candice Santora, Quakertown, PA, 18951
Christina E Dickson, Black Mountain, NC, 28711
Lisa Crum-Freund, Port Townsend, WA, 98368
Judy Whitehouse, Phoenix, AZ, 85008
William Fisk, Palm Bay, FL, 32905
Lyn du Mont, Golden, CO, 80401
Jessica Saucedo, San Antonio, TX, 78254
Clifford Provost, New York, NY, 10065
Elaine Forester, Goleta, CA, 93117
Kathleen Roche, Bend, OR, 97701
Nora Polk, Portland, OR, 97206
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Elaine Livesey-Fassel, Los Angeles, CA, 90064
Ilana Krug, Idlewylde, MD, 21239
Patricia Nadreau, Tomah, WI, 54660
Stacy Bouilland, Boca Raton, FL, 33486
LISA WILSHER, Francestown, NH, 03043
Cody Traweek, Hillsboro, OR, 97124
Stephen Vaughan, Tucson, AZ, 85750
Alyssa Huebner, Brooklyn, NY, 11235
Mary Tuma, Charlotte, NC, 28205
Eddie Konczal, Monroe Township, NJ, 08831
Robert Lombardi, Brooklyn, NY, 11234
Lori Rumpf, Lansing, MI, 48910

Maureen McCarthy, Marblehead, MA, 01945
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Jennifer DiMarco, Hickory, NC, 28601
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Jessica Heiden, Eureka, CA, 95503
Rosemary Caolo, Scranton, PA, 18510
Lynette Rynders, Strasburg, CO, 80136
Ellen Halbert, Drayden, MD, 20630
Stephen Kobasa, New Haven, CT, 06511
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Toby ann Reese, Valley City, OH, 44280
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Jennifer Brandon, Lexington, NC, 27295
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Barbara MADDALENA, Teaneck, NJ, 07666
Vicki Matheny, Palm Coast, FL, 32164
Cynthia Brooks-Fetty, Leoti, KS, 67861
Donna Leavitt, Toms River, NJ, 08753
Marcy Golde, Seattle, WA, 98109
Kathy Alcott, South Portland, ME, 04106
Susan Welsford, Norton Shores, MI, 49441
Barbara Smith, Tucson, AZ, 85742
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Shonna Davis, Houlton, ME, 04730
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Christine Stewart, Escondido, CA, 92026
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Kevin Walsh, Madison, CT, 06443
Michael Peterman, Parker, CO, 80138
Kathi Thonet, Pittstown, NJ, 08867
Karen Swistak, Newmarket, NH, 03857
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Peter Lee, San Francisco, CA, 94118
Cathy Silva, Vandalia, IL, 62471
Sandra Linabury, Mattawan, MI, 49071
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Virginia Johnston, Keene, NH, 03431
Debra Smith, Milwaukie, OR, 97267
Dorothy Dobbyn, Millsboro, DE, 19966
Lori West, Coronado, CA, 92118
Matthew Ramirez, Rancho Cucamonga, CA, 91737
Erin Gulick, Leesburg, VA, 20175
Barbara Lindsey, Pensacola, FL, 32506
Christopher Ware, Fremont, CA, 94539
Susan Peters, San Rafael, CA, 94901
Anna Goble, Boerne, TX, 78006

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Loretta Olsen, Wilmington, OH, 45177
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Madeleine Glick, New York, NY, 10010
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Susan Harrie, Grand Forks, ND, 58201
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Ellen Murphy, Bronx, NY, 10465
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Sally Mikkelsen, Princeton, NJ, 08540
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Melissa Wiens, Wichita, KS, 67209
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Bonnie Algarin, Oakland, NJ, 07436
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Michael Mahaffa, Brush Prairie, WA, 98606
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Gretchen Corkrean, Woodbury, MN, 55125
MaryAnn and Frank Graffagnino, Tucson, AZ, 85747
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Gregory Penchoen, Roy, WA, 98580
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Terri Neill, Cape Neddick, ME, 03902
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Mario Velarde, Hialeah, FL, 33015
Steven Andrychowski, New Britain, CT, 06051
Erin Howard, Brooktondale, NY, 14817
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Jane Heltebrake, Perrysburg, OH, 43551
Charles Hines, Millersville, PA, 17551
Stacey Bonette, Kingston, NJ, 08528
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Kristin Crage, Yonkers, NY, 10704
Edward Smith, Fort Worth, TX, 76103
Michele Hamilton, Joshua, TX, 76058
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Brenda Miller, Gallatin, TN, 37066
Cynthia McKeen, Saint Paul, MN, 55102
Linda Andrews, Canterbury, CT, 06331
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Diane Rohn, McLean, VA, 22101
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Corey Schade, Loch Arbour, NJ, 07711
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Carole Menninger, Katy, TX, 77450
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Cheryl Gilchrist, Saint Louis, MO, 63109
Helen Lozoraitis, Mattapoisett, MA, 02739
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Jacqueline Drewes, Eaton Rapids, MI, 48827
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Heather Murawski, Renton, WA, 98058
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Marilyn Fuller, Los Gatos, CA, 95033
Pedro Mier, Jackson Heights, NY, 11372
Susan Castelli-Hill, Melville, NY, 11747
Skot McDaniel, Novato, CA, 94945
Angela Jones, Lees Summit, MO, 64082
Francis Groff, Brielle, NJ, 08730
Sue Batchelor, Bryan, TX, 77803
Judy Cacioppo, Bessemer, AL, 35022
jon brock, Dallas, TX, 75220
Bruce MacBryde, Drake, CO, 80515
Margo Wyse, Mimbres, NM, 88049
PETER GALVIN, Whitethorn, CA, 95589
John Heyneman, Webster, NY, 14580
Ann Marie Connor, Roseville, MN, 55126
Harrison Hilbert, Pocatello, ID, 83204
mohsen shenas, Whitewright, TX, 75491
Hazel McCoy, Longmont, CO, 80501
Heyward Nash, Minneapolis, MN, 55404
Jan Jones, El Cerrito, CA, 94530
Phillip Hope, New York, NY, 10009
Connie Raper, Saint Francis, SD, 57572
Lacey Levitt, San Diego, CA, 92120
Mary Bissell, Somerville, NJ, 08876
Barbara Bonfield, Tacoma, WA, 98407
Kim Wick, Buxton, OR, 97109
Sandy Williams, Covina, CA, 91723
Marija Minic, Las Vegas, NV, 89129
Eric Hensgen, Tampa, FL, 33609
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Nora Privitera, Oakland, CA, 94602
Rebecca Barker, Glendora, CA, 91741
rachael stalker, Glen Haven, CO, 80532
Colleen Bergh, Santa Ana, CA, 92704
Chris Loo, Morgan Hill, CA, 95037
Pauline Rosenberg, Philadelphia, PA, 19151
Keil Albert, Cupertino, CA, 95014
Natalie me Quiet, Wheat Ridge, CO, 80033
Renee Schofield, San Anselmo, CA, 94960
MaryFrances VanHornHarris, Cantonment, FL, 32533
Cheryl Fergeson, Ogden, UT, 84401

Martha Eberle, Dripping Springs, TX, 78620-3503
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Judy Hoaglund, Santa Rosa, CA, 95401
Charles Favorite, Isle, MN, 56342
Rosalba Cofer, Galt, CA, 95632
Joyce Benson, Ambler, PA, 19002
Robin Kladke, Roseburg, OR, 97471
Belinda Hedge, Lenoir City, TN, 37771
Martin Henderson, Goleta, CA, 93117
Jess Galchutt, Rochester, NY, 14622
Moraima Suarez, Brooklyn, NY, 11232
Marie Alabiso, Plymouth, MA, 02360
Linda Rogers, Spring Lake, MI, 49456
Janet Carmichael, Shawnee, KS, 66216
Gregory Mikkelson, Bryant, WI, 54418
Marilyn Brown, Matthews, NC, 28105
Felicia Bander, Sebastopol, CA, 95472
Kathy Brown, Ballwin, MO, 63021
Janet McGraw, Syracuse, NY, 13207
Holger Mathews, Seattle, WA, 98134
Lori Stefano, Yelm, WA, 98597
WALTER CONNELLY, Tolland, CT, 06084
Janet Draper, Kalamazoo, MI, 49048
Liz Erpelding-Garratt, Saint Augustine, FL, 32086
Samuel Matos, Willimantic, CT, 06226
Diane Craig, Beaverton, OR, 97008
carolyn Walker, Greene, NY, 13778
josephine baldwin, La Mesa, CA, 91941
Jim Bearden, Rochester, NY, 14612
Amanda Lowe, Boise, ID, 83702
Marjorie Millner, Vancouver, WA, 98685
Mindy Blaski, Tucson, AZ, 85750
Reeve Love, Albuquerque, NM, 87110
Martha Siegel, Santa Barbara, CA, 93105
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Mary Lundeberg, Nokomis, FL, 34275
Crystal Hart, Leesburg, VA, 20175
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Nancy Lackaye, Greenbelt, MD, 20770
Maude Burns, Rochester, NY, 14620
Susan Hubbard-Reeves, Pensacola, FL, 32504
nick scarim, Hennepin, IL, 61327
Genevieve Shank, Friday Harbor, WA, 98250
Thomas Richman, Phoenix, AZ, 85016
Edward Hubbard, Madison, WI, 53705
Raymond Zahra, Florissant, MO, 63033
Brennan Nerhus, San Luis Obispo, CA, 93401
Ilene Kazak, Brighton, MI, 48116
Mariam Andalibi, Andover, NJ, 07821
Melissa Ward, Zephyrhills, FL, 33540
Colleen Carroll, Tampa, FL, 33625
Sandra Middour, Round Hill, VA, 20141
Laurie Hidy, Wofford Heights, CA, 93285
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Mary-Helen Sullivan, Richmond, VA, 23220
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Arline Fass, Green Valley, AZ, 85614
Linda Webb, Rancho Palos Verdes, CA, 90275
Susan Summers, Carmichael, CA, 95608
Marsha Lowry, El Sobrante, CA, 94803
Paul Lapidus, Aromas, CA, 95004
Justin Philipps, Newark, OH, 43055
Paul Franzmann, Walla Walla, WA, 99362
Carole Williams, Morgantown, WV, 26505
Summer Crabtree, Jacksonville, FL, 32257
Diana Sheen, Bath, ME, 04530
Kathy Mason, Sebewaing, MI, 48759
Hilary Persky, Princeton, NJ, 08540
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Roger Pritchard, Berkeley, CA, 94703
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Bettina Hempel, Teaneck, NJ, 07666
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Amy Pfaffman, Asheville, NC, 28803
Doris Applebaum, Oak Park, MI, 48237
Alana Willroth, White Bear Lake, MN, 55110
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William Guthire, Bluemont, VA, 20135
Catherine Zimmer, Saint Paul, MN, 55104
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Evelyn Och, Pittsburgh, PA, 15232
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Tibor Gacs, , Budapest, 01222
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Chase Martin, Alameda, CA, 94501
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Kathy Hutson, Abingdon, VA, 24210
Linda Johnson, San Mateo, CA, 94401
Michele Villeneuve, Kingsport, TN, 37660
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Kathleen obre, Venice, FL, 34293
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Brenda Frey, West Seneca, NY, 14224
Barbara Mieirs-Denton, Orangevale, CA, 95662
Marcy Gordon, Brooklyn, NY, 11233
Sharon Furlong, Feasterville Trevose, PA, 19053
Chris Seaton, Santa Barbara, CA, 93101
Janna Moore, Westfield, IN, 46074
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Tatiana Méndez, Silver Spring, MD, 20910
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Patricia Bocanegra, San Antonio, TX, 78231
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Elizabeth Davidson, West Hartford, CT, 06107-1105
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Patricia Horejsi, Flagstaff, AZ, 86004
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Barbara Kane, Minneapolis, MN, 55430
L. Adams, Ventura, CA, 93004
Violet Yamasaki, Long Beach, CA, 90814
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Terri Knauber, Buffalo, NY, 14225
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Daniel Perdios, Buzzards Bay, MA, 02532
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Jessica Freeman, Hopewell, VA, 23860
Jacqueline Schmidt, Watervliet, MI, 49098
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Robin Coleman, Las Vegas, NV, 89121
Kimberly Tostenson, Marshall, MN, 56258
Susan Balogh, West Roxbury, MA, 02132
Ellen Smith, Naples, FL, 34109
Jason Crawford, Lancaster, PA, 17601
Eric Robinson, Memphis, TN, 38104
Mitzi Deitch, Feasterville Trevose, PA, 19053
Maureen Ellis, Chicago, IL, 60613
Jack Roberts, Lancaster, PA, 17603
Stacey Lightfoot, Williamsburg, VA, 23185
Thomas Ray, Novato, CA, 94945
Jill Wettersten, Oberlin, OH, 44074
Francine Kubrin, Los Angeles, CA, 90049
Deborah Baker, Indianapolis, IN, 46234
Linda Pflugrad, Kenosha, WI, 53142
Brian Jay, Omaha, NE, 68104
TERESA PITTS, Glen Alpine, NC, 28628
Elizabeth Seltzer, Media, PA, 19063
terri pigford, Dayton, OH, 45417
Bonnie Svec, Rockville, MD, 20853
Laurie Gates, South Chatham, MA, 02659
Janet Geldert, Fort Collins, CO, 80525
Martin Watts, , NSW, 02760
Janelle Murphy, Texas City, TX, 77590
Brad Nahill, Portland, OR, 97206
Melissa Sunderland, Sherman Oaks, CA, 91403
Clint Landeen, Canby, OR, 97013
Elizabeth Long, Brooklyn, NY, 11222
Rose Ann Bellotti, San Diego, CA, 92104
Donald Mackler, Blacksburg, VA, 24060
Stacey Dillingham, Louisville, KY, 40245
Brooke Scruggs, Encinitas, CA, 92024
Elaine Preston, Rockville, MD, 20853
Mike Shields, Henderson, KY, 42420
Georgette Engard, Grand Blanc, MI, 48439
Tisha Dehart, Lexington, KY, 40517
Paul Williams, Toms River, NJ, 08757
Derek Collett, Nashport, OH, 43830
Kathleen Neely, St Petersburg, FL, 33712
victoria khazzam, Stamford, CT, 06902
Charlotte Harbeson, Bishop, CA, 93514
Stan Janzick, Bronx, NY, 10465
Denna Bowman, Louisville, KY, 40223
Shannon Hunter, Anderson, CA, 96007
William Morgan, Pottstown, PA, 19465
Wynne Dimock, Birmingham, AL, 35210
Eileen Jennis-Sauppe, Eureka, CA, 95501
kathleen Lavelle, , BC, 90065
Cassie Shannon, Haltom City, TX, 76117
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Eric Duggan, Pahrump, NV, 89060
Eric Rutman, Leicester, MA, 01524
Hannah MacLaren, Altadena, CA, 91001
Russell Symonds, Costa Mesa, CA, 92627
Mitchell Mead, , , 77389
Michelle Yarber, Fountain Hills, AZ, 85268
Debbie Griffin, Windermere, FL, 34786
Wayne Cohen, , , 02762
Jon Mullin, Irving, TX, 75038
Guy Taylor, Livonia, MI, 48152
John Holland, Barre, MA, 01005
Patricia Bowman, Portland, OR, 97229
Janis Hadley, Seattle, WA, 98119
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Sam Fernandez, Greeley, CO, 80631
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Julia OConnor, Williamston, MI, 48895
CARL LUHRING, Vista, CA, 92083
Thomas Littelmann, Milwaukee, WI, 53216
Kristy Giles, Clackamas, OR, 97015
Stacy Rutkowski, Aurora, IL, 60504
Emily Sapp, La Mesa, CA, 91941
Suz Cerniglia, Lake Worth, FL, 33460
Susan Fischer, Santa Rosa, CA, 95403
Francelia Lieurance, Salida, CO, 81201
David Welch, Golden, CO, 80403
Barbara Buck, Apache Junction, AZ, 85119
Georgia Forbes, Clio, MI, 48420
Patricia Tamagini, New York, NY, 10024
C S, Spring Hill, FL, 34609
David Nichols, Portland, OR, 97213
Martha Tack, Wetumpka, AL, 36092
Michael Renfrow, Portland, OR, 97213
Colette Van Os, Westminster, CO, 80030

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Denine Heinemann, Portland, OR, 97217
Gail Smallridge, Millerton, NY, 12546
Wanda Graff, Canby, OR, 97013
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Shari DePauw, Montrose, CO, 81403
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Diane Bastian, Liberty, PA, 16930
Alice Hudson, Lakeland, TN, 38002
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Amanda Dickinson, Yakima, WA, 98902
Grisel Rodriguez, Miami, FL, 33169
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Tiffany Deal, Airville, PA, 17302
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Erin Burnett, Blairstown, NJ, 07825
Janice Brooks, Redwood City, CA, 94061
Sagar Patel, Westborough, MA, 01581
Janet Frisella, Williams, OR, 97544
Ray Rooney, Ocala, FL, 34481
Jill Godmilow, New York, NY, 10036
Karen Schlais, New Berlin, WI, 53151
David Dougherty, New Britain, CT, 06053
Bonnie Arbuckle, Riverbank, CA, 95367
Pam Wallace, Greeneville, TN, 37743
Nicholas Kovalcik, Bozeman, MT, 59718
Leslie Mlawski, Woodmere, NY, 11598
James Bengel, Wendell, NC, 27591
Carolyn Rhazi, Mission Viejo, CA, 92691
Mark Smith, Oconto Falls, WI, 54154
Rosi Meza-Steel, Washington, DC, 20037
Laurie Rowe, Delmar, NY, 12054
Ruth Schaut, Munising, MI, 49862
Linda Campbell, Emmaus, PA, 18049
Theresa Rolla, Savoy, IL, 61874
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Michele Barnes, Valrico, FL, 33596
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Karen Milstein, Santa Fe, NM, 87505
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Teresa O. Looney, Land O Lakes, FL, 34639
Susie Lopez, El Paso, TX, 79938
Barbara McCane, Chesapeake, VA, 23325
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Jeffrey LaGasse, Freeland, WA, 98249
Pam Bacon, Lexington, NC, 27292
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Barbara Burgess, Hanover, PA, 17331
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Karen Runk, North Smithfield, RI, 02896
Gladys Simerl, Brookfield, WI, 53045
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Ronnie Bolling, Green Cove Springs, FL, 32043
Maija Nevalainen, , , 00509
Annie Laurie, Dracut, MA, 01826
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Joann Gray, Marion, IA, 52302
Joan goodfellow, Wilmington, DE, 19805
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Patricia Hammel, Branford, CT, 06405

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Deborah Burge, Garden Valley, CA, 95633
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Adrian Bergeron, Halfway, OR, 97834
Anna Drummond, Grass Valley, CA, 95949
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Susan LeClair, Campbell, CA, 95008
Julie Kanoff, Sacramento, CA, 95819
Debbie Krapf, Valdosta, GA, 31601
Gabriela Elias, , AK, 12300
Lynne Waymon, Newtown, PA, 18940
Laura Coglan, Bokeelia, FL, 33922
Jocelyne Pinque, , Sélectionner, 83700
Jacqueline Glyde, , , 97252
Bodhi Amala, , Baden-Württemberg, 71662
Eliette Bozzola, , , 33070
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Thomas Stander, Show Low, AZ, 85901
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Diane Langejans, Irvine, CA, 92606
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Walter Thurber, Scottsdale, AZ, 85258
Debra Spagnola, Chicago Heights, IL, 60411
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Song Kinnamon, Pelzer, SC, 29669
Lauretta Padgett, Sullivan, IN, 47882
Ann Fisher, West Springfield, MA, 01089
Steven Radzik, Worcester, MA, 01609
Ellen Federman, Toledo, OH, 43606
Chris Silcox, Wooster, OH, 44691
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Steve Bogart, Gladstone, NJ, 07934
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Bobby Belknap, Raleigh, NC, 27608
Helene Bank, Cambridge, MA, 02139
Amy Cyr, Tolland, CT, 06084
Bonnie Ellis, Westborough, MA, 01581
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Rita Pesini, North Wales, PA, 19454
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Randi Justin, Lauderdale Lakes, FL, 33319
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Sonya Curry, Pierron, IL, 62273
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cecilia nevel, Saint Augustine, FL, 32086
Lawrence Lee Adrian, Durham, NC, 27713
Sue Lundquist, Ashland, OR, 97520
Rhonda Berger, Espanola, NM, 87532
Cathy Holden, Sacramento, CA, 95864
Sylvain Beloin, North Granby, CT, 06060
Mark Houdashelt, Fort Collins, CO, 80521
Theresa Morris, Henrico, VA, 23233
Allan Campbell, San Jose, CA, 95132
Cristina Economides, , AK, 10433
Tobey Thatcher, Sahuarita, AZ, 85629
Debra Megela, Jeannette, PA, 15644
Allison Souza, San Diego, CA, 92109
Erin McDonald, Portland, OR, 97216
Korinne Taylor, Palm Desert, CA, 92211

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Phyllis Grande, New York, NY, 10011
John MacKey, Chicago, IL, 60618
Sam Inabinet, Virginia Beach, VA, 23464
Jennifer D'Angelo, Attleboro, MA, 02703
Myles Robertson, Tallahassee, FL, 32308
Dolores Varga, Gold Canyon, AZ, 85118
Paula Silver, Oakland, CA, 94602
Kent Borges, Colorado Springs, CO, 80904
Mary Mahoney, Quincy, MA, 02170
Lisa Fisk, Burlington, NC, 27217
Carina Chadwick, Los Angeles, CA, 90019
Sharon Wolfe, Oakland, CA, 94607
Lois Nowak, , IL, 60630
Mark Hogan, Denver, CO, 80206
Liz Ofstad, Sioux Falls, SD, 57108
S G, Mays Landing, NJ, 08330
Ann Dorsey, Northridge, CA, 91325
Robert Gumlock, Bethlehem, PA, 18018
Pat Jones, Deming, NM, 88030
Roy Wessbecher, Brookings, OR, 97415
Linda Waine, Taunton, MA, 02780
Margaret Nelson, Boston, MA, 02111
Dalia Salgado, Los Angeles, CA, 90017
Angelica Freitag, Alexandria, VA, 22310
Melissa Miranda, Aliso Viejo, CA, 92656
Duncan Carlyle, North Little Rock, AR, 72116
Cameron Carlyle, Little Rock, AR, 72205
William Carlyle, North Little Rock, AR, 72116
Clint Jones, Ward, AR, 72176
Daisy Carlyle, North Little Rock, AR, 72116
Joan Raitano, Seaford, NY, 11783
Elizabeth Bullock, Poolesville, MD, 20837
Eric Kocher, Anderson, SC, 29625
Pat DeLaney, Sainte Genevieve, MO, 63670
Dana Petre-Miller, Keizer, OR, 97303
Brian Dreckshage, Ballwin, MO, 63021
Carmen Patti, Davie, FL, 33325
Mandy Redder, Soldotna, AK, 99669
Brett Martin, West Stockbridge, MA, 01266
Linda Lamp, Albemarle, NC, 28001
Autumn Headlee, Carlisle, IA, 50047
Andrew Hellinger, Chicago, IL, 60613
Noah Ehler, Carnation, WA, 98014
Suzette ippolito, Pittsburgh, PA, 15215
Erica Goodwin, , Kent, BR1 4TA
John Kunick, Cutler Bay, FL, 33189
Kimberly Harrison, Lakeland, FL, 33813
Marsha Smith, Dryden, NY, 13053
Joann Reisman, Wellington, FL, 33414
Zbigniew Stein, Port Charlotte, FL, 33948
Lynn Pooley, Lakewood, OH, 44107
Robin Swope, Fairfax Station, VA, 22039
David Elman, Woodside, NY, 11377
Scott Maclowry, Bend, OR, 97703
Anna Holstrom, Bozeman, MT, 59718
Sandra Jensen, Clarkdale, AZ, 86324
Sheila Anderson, Amherst, MA, 01002
MARJA LEINO, New York, NY, 10012
April Wickman, Clarksville, TN, 37043
Dianne Maughan, Grand Lake Stream, ME, 04668
Christina Nielsen, San Jose, CA, 95120
Susan Scheck, Islandia, NY, 11749
Florencia Morales, Fort Worth, TX, 76137
Brian Benjamin, Alpine, CA, 91901
Jordan Hayes, Camden, SC, 29020
Cheryl Mitchell, Spokane, WA, 99205
Brian White, West Palm Beach, FL, 33411
Christina Vosilla, Deerfield Beach, FL, 33441
MICHAEL GOEHRING, Fort Lauderdale, FL, 33308
Debra Rehn, Portland, OR, 97202
Marcia Ouellette, Lafayette, IN, 47905
Maurice Samuels, Verona, PA, 15147
Heather Henrickson, Shorewood, WI, 53211
Robin Weirich, Irvine, CA, 92618
Vicki L Smith, Running Springs, CA, 92382
V. Frick, York Harbor, ME, 03911
Joseph Kenosky, Mount Pocono, PA, 18344
sharon greenrod, Cleveland, OH, 44111
Eileen Jones, Woodridge, IL, 60517
Tamara Noel Swart, Attica, MI, 48412
Alisha Seaton, Los Angeles, CA, 90066
Shawn Sori, Mullica Hill, NJ, 08062
Celeste Hill, Freeport, NY, 11520

Michele Cardone, Hopatcong, NJ, 07843
Monica Leccese, Wonder Lake, IL, 60097
Bret Barrick, Portland, OR, 97209
Vena Campbell, Cincinnati, OH, 45237
Sophie Rocheleau, Arcata, CA, 95521
Theresa Peckham, Portsmouth, RI, 02871
Shirin Wertime, Arlington, VA, 22206
Erin Richardson, Swanton, OH, 43558
Taffi Newhouser, Reston, VA, 20191
Maria Miranda, Brooklyn, NY, 11222
LINDA KOLLMAN, Richfield, MN, 55423
Christina DeRespiris, Baldwin Place, NY, 10505
Julie Amani, Pittsboro, NC, 27312
Mil Drysdale, New York, NY, 10016
Bob Roach, Pittsburgh, PA, 15214
Tammery Ray, Nashville, TN, 37206
Jennifer Krinke, Saint Paul, MN, 55104
Denise Nutt, Reynoldsburg, OH, 43068
Pamela Weaver, Fairbanks, AK, 99709
Patricia Williamson, Mount Arlington, NJ, 07856
Leslie Richardson, Columbus, NC, 28722
Anna Frazier, Boulder, CO, 80302
Jakob Radovic, Clairton, PA, 15025
Carl Palmer, Rockingham, VA, 22801
Gary Lichtenberg, Temple Terrace, FL, 33617
Louise Proulx, Wayland, MA, 01778
Tascha Babitch, Portland, OR, 97214
Pamela Youngquist, Great Barrington, MA, 01230
Catherine Sims, Durham, NC, 27713
Carol Lipsky, New York, NY, 10021
mackenzie reilly, New York, NY, 10024
Stacie Umetsu, Huntington Beach, CA, 92649
Katie Desmond, Tucson, AZ, 85716
Amanda Griffin, Marriottsville, MD, 21104
Donna Hunt, Lake Elsinore, CA, 92530
Julia Farhat, Beacon, NY, 12508
kathryn Reichard, Santee, CA, 92071
Amy Elston, Belleville, IL, 62220
Dallas Windham, Irving, TX, 75038
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Marilyn Shup, Asheville, NC, 28803
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Carmela Sudano, Midvale, UT, 84047
Kevin Bannon, Sussex, NJ, 07461
sheila munson, Springfield, NJ, 07081
Cheryl Frank, Rochester, NY, 14618
Erica Pais, Pittsburgh, PA, 15235
Ronald Drahos, Bloomington, IN, 47401
Richard Stern, New York, NY, 10023
Daniel Tiarks, Los Angeles, CA, 90046
David Gustafson, Moline, IL, 61265
Helen Buckley, Chattanooga, TN, 37421
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Richard Tregidgo, Holtwood, PA, 17532
MARYELLEN REDISH, Palm Springs, CA, 92262
Lynne Gaudette, Candler, NC, 28715
Michele Johnson, Yorktown Heights, NY, 10598
Berry Dilley, Athens, OH, 45701
Mark Meeks, Bailey, CO, 80421
Rona Homer, Scottsdale, AZ, 85255
Susan Brown, Evergreen, CO, 80437
Kenya Pena, Bronx, NY, 10463
George Lee, Kingsport, TN, 37660
James Dawson, Davis, CA, 95618
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Wendy Wish, Orlando, FL, 32806
Kathryn Melton, Deer Park, TX, 77536
Richard Bachman, Houston, TX, 77006
Ed Perry, New Braunfels, TX, 78132
Laura Rushton, Strongsville, OH, 44149
Nichole Holden, Marshalltown, IA, 50158
Mary kleinbach, Mertztown, PA, 19539
Karl Hamann, Red Wing, MN, 55066
V Truong, North Fork, CA, 93643
SG Sutriasa, Rollingbay, WA, 98061
Carol Glazer, Monsey, NY, 10952
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nando Ab, Des Moines, WA, 98198
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Constance Lorig, De Pere, WI, 54115
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Gloria D., Cataldo, ID, 83810
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Mary E Casale, Goodyear, AZ, 85395

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Deborah Sheinman, Colorado Springs, CO, 80907
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Jess Turner, Longmont, CO, 80501
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Ruthie Weller, Woodway, TX, 76712
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Karen Hewelt, Algonac, MI, 48001
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Suzanne Swinconos, Janesville, WI, 53548
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Lorraine Martinez, Indian Mound, TN, 37079
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Sara Keesling, Chesterfield, VA, 23838
Rosalyn Rohloff, Golden, CO, 80403
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Nancy Arbuckle, San Francisco, CA, 94109
Amanda Nace, Anchorage, AK, 99515
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Sarah Stahelin, Bemidji, MN, 56601
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Anne Elkins, Anacortes, WA, 98221
Cathy Wootan, Cleveland, OH, 44109
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Rob Seltzer, Malibu, CA, 90265
Ken Gibb, Zephyr Cove, NV, 89448
M. Virginia Leslie, Milpitas, CA, 95035
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Liz Brown, San Marcos, CA, 92069
Joan Ford, Plantsville, CT, 06479
Sheila Silan, Somerset, CA, 95684
Teresa Coble, Springfield, OR, 97478
Susan Whipple, Madison, OH, 44057
Robyn Tatom, Bend, OR, 97702
Vijay Anastasia De Simone, Albuquerque, NM, 87112
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Stephanie Cybulski, Buffalo, NY, 14225
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Cynthia Obert, Thompson, CT, 06277
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Peter Cutting, Charlton, MA, 01507
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Simon Shrimpton, , , 95530
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Dennis and Susan Kepner, York, ME, 03909
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David Atwater, Wakefield, MA, 01880

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Dr Eric Zwick, Allentown, PA, 18062
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Charity Allaburda, Naugatuck, CT, 06770
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S Bramley, Manchester, NH, 03102
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Leah Allers, Franklin, TN, 37064
Helen Lahoda, Berkeley, CA, 94710
Nancy Beavers, Asheville, NC, 28806
Ron Snyder, Anderson, SC, 29625
Adrienne Zinbi, , NS, B3A3B7
Nancy Fay-Muzar, Columbus, IN, 47201
Scott orman, Floral Park, NY, 11005
Danielle Hipworth, Orlando, FL, 32804
Eleanor Thompson, , MT, 00000
Laura Reedy, Jeffersonville, IN, 47130
Robert Kyle, Columbus, OH, 43230
Shirley Christensen, Tucson, AZ, 85743
Fabiola Delgado, Tucson, AZ, 85704
Dina Dina Reid, Albuquerque, NM, 87112
Gerry Masurat, Maywood, NJ, 07607
Alexistori Gonzalez, Belle Chasse, LA, 70037
Kai Butscher, Duluth, GA, 30096
Renata Hennell, , , 95946
Rose Dean, Caledonia, MN, 55921
Priya DasSarma, Ellicott City, MD, 21042
Janet Mullen, Downers Grove, IL, 60515
Cynthia Costanza, Colorado Springs, CO, 80920
Deborah R. Ellstrom, Worcester, MA, 01610
Sara Post, Girard, OH, 44420
Em Gerety, Eustis, FL, 32726
Dan Fernandez, Madison, TN, 37115
Jinny Miranda, North Easton, MA, 02356
James Pankanin, Bellevue, WA, 98006
SIDNEY WINSTON, Los Angeles, CA, 90043
Laurel Douglass, Marshall, VA, 20115
Gregory V, Brooklyn, NY, 11201
Joan Davenport, Mount Airy, MD, 21771
Craig Clapper, Mediapolis, IA, 52637
Debbie Crosset, Granby, CT, 06035
Cassidy Thompson, Columbus, OH, 43220
jerry owings, Ames, IA, 50010
Kathleen Cevette, Albany, NY, 12204
Lura Brookins, Santa Fe, NM, 87505
Minna Penttinen, , AK, 02600
Jacqueline Bimbaum, Bronxville, NY, 10708
Robin Stalcup, Woodburn, OR, 97071
Steve B, , , 00000
Karen Kirkhart, Syracuse, NY, 13214
I Stanelun, Studio City, CA, 91604
Jodi Weiskott, Silver Spring, MD, 20906
Amy Hansen, Asbury, NJ, 08802
Lori Hood, Corbett, OR, 97019
john alder, Spokane, WA, 99207
Barry Pendergrass, Albany, NY, 12208
Jeweliette Pearson, Oakland, CA, 94606
Carol Williams, , NY, 14225
Donna Plutschuck, Dillon, CO, 80435
James A Taylor, Las Vegas, NV, 89103
Michele Mattioli, Charlottesville, VA, 22903
Tack Martha, Wetumpka, AL, 36092
Jeannie Belton-Rumple, Post Falls, ID, 83854
X Harris, Delmar, NY, 12054
Margaret for Indivisible Yolo, Davis, CA, 95616
Charles Hammock, Dade City, FL, 33523
L Uchno, Sylvan Lake, MI, 48320
Linda Gill, , , N39 YW61
kay Powers, Greensboro, NC, 27455
Alan Brennock, , , 08025
KIMBERLY KOZAKIEWICZ, Howell, NJ, 07731
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Katherine Kowalczyk, East Hampton, CT, 06424
High Patricia, Interlachen, FL, 32148
Jenna Parker, Fort Collins, CO, 80525
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Amy Eisenberg, Tucson, AZ, 85737
Kate Hermann-Wu, Waltham, MA, 02451
David Mickelsen, Waltham, MA, 02453
K D, Irvington, NY, 10533
Bernadette Dobos, Pengilly, MN, 55775
Elizabeth Field, Willoughby, OH, 44094
paula drumcea, , dobrogea, 900131
Cecilia Correia, Roselle, NJ, 07203
Regina M Cracchiolo, Bradenton, FL, 34203

Kristin Arce, Miami, FL, 33165
Cecilia Caiano Correia, Elizabeth, NJ, 07208
Rita Glasscock, Santa Fe, NM, 87507
Jose de Arteaga, Washington, DC, 20020
Rainbow Di Benedetto, Austin, TX, 78750
Janet Kaylo, Savannah, GA, 31401
Scott Tipton, Concord, CA, 94521
Geneva Andrews, Dayton, TN, 37321
Deborah Gibson, Estes Park, CO, 80517
Kristine Barbieri, Columbia, MD, 21045
jason husby, Minneapolis, MN, 55412
Heather Higgins, Lubbock, TX, 79423
Adrienne Ross, Lamy, NM, 87540
Marilyn Evenson, Norwalk, OH, 44857
Mary Hood, Plain City, OH, 43064
Leslie O'Loughlin, Amarillo, TX, 79106
Randall Webb, Chicago, IL, 60611
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Carolyn Raasch, Philipsburg, PA, 16866
Patricia Burgert, Wake Forest, NC, 27587
Abigail Gindele, Portsmouth, NH, 03801
Barty Thompson, Mohnton, PA, 19540
c s, New York, NY, 10025
Anne Randolph, Yellow Springs, OH, 45387
NANCY GODWIN, Tucson, AZ, 85748
Harriet Shalat, Forest Hills, NY, 11375
Eric Nichandros, Castro Valley, CA, 94552
Deborah Rubinfine, Ancramdale, NY, 12503
Teresa Yuan, Chantilly, VA, 20151
Lynn Erckmann, Kirkland, WA, 98033
Amy McCoy, Shelburne Falls, MA, 01370
Catherine Webster, Pine, AZ, 85544
Nezka Pfeifer, Saint Louis, MO, 63110
Marilyn Waltasti, Maricopa, AZ, 85138
Thomas Hernandez, Henderson, NV, 89011
Susan Thabit, Chesterland, OH, 44026
Lilli Ross, New York, NY, 10024
Rachel Rakaczky, Sparks, NV, 89431
Miriam Baum, Alta Loma, CA, 91701
John Dervin, Apopka, FL, 32712
Stacie Hall, Oregon City, OR, 97045
Romy Overstreet, Indianapolis, IN, 46220
Deanne O'Donnell, Derry, PA, 15627
Patricia Akers, Keenesburg, CO, 80643
Peter Curia, Scottsdale, AZ, 85257
Lenore Kester, Benson, AZ, 85602
Christopher Dunham, Feasterville Trevose, PA, 19053
Christopher Lish, San Rafael, CA, 94903
gary baxel, Cathedral City, CA, 92234
Penny Stanaitis, Limerick, PA, 19468
Monica Padilla, La Mesa, CA, 91942
Mike Acosta, Riverside, CA, 92504
Katherine Humphries, Rutherfordton, NC, 28139
Deb Kalahan, Renton, WA, 98059
Joan Walker, Big Pine, CA, 93513
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Lynda Alvarez, Arlington, TX, 76013
Mark Emlet PAc, Clifton, VA, 20124
Martha Lynch, Staten Island, NY, 10314
Lorraine Socorro, Yonkers, NY, 10710
Lee Jones, Saint Albans, WV, 25177
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Melissa Pearson, Kingsport, TN, 37660
Meredith Walters, Decatur, GA, 30033
Paula Carlson, Milwaukee, WI, 53215
Judith Hart, Eagle, ID, 83616
Rosie LeMire, Stevensville, MT, 59870
Jenny Ruckdeschel, Lynn, MA, 01901
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Allison Kiser, Camp Hill, PA, 17011
Susanna Knittel, Santa Monica, CA, 90403
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Jane Lyon, Cotati, CA, 94931
Olga Ros Celis, , Spain/Barcelona, 08901
Adolfo Ros Lozano, , Barcelona, 08901
Sandra Ros Celis, , Barcelona, 08901
Olga Celis Outumuro, , Barcelona, 08901
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Kerry Bryan, , England., Me7 4pz
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Ellen Grasmück, , Hessen, 63654
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Paolo Pró, , , 15023
Magdalena Borowska, , Warsaw, 01562
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Gisela Rohe, , Rheinland-Pfalz, 56869
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Linda Chapman, Olympia, WA, 98513
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Helle Juul Hansen, , , 04780
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Sharon Neal, Methuen, MA, 01844
Pierre Desombre, Scottsdale, AZ, 85251
Sandra Lee, Rohnert Park, CA, 94928
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Corinne Woodland, Bradenton, FL, 34209
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Vera Brooks, New York, NY, 10009
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Sharon Hefke, San Francisco, CA, 94123
Karen Mason, Southfield, MI, 48033
Morgan Crawford, Raleigh, NC, 27614
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Laurie Bamford, Waukesha, WI, 53188
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Jon Schroeder, Minneapolis, MN, 55431
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Melissa Harris, Nashville, TN, 37215
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Diane Landers, Corvallis, OR, 97330
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Crystal Headrick, Chuckey, TN, 37641
Sophia Santitoro, Simi Valley, CA, 93065
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Judith gorman, Soap Lake, WA, 98851
Joanna Tang, Goleta, CA, 93117
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Jack Anderson, Richmond, VA, 23226
Jack Demorra, Delmar, MD, 21875
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Kaitlin Baylie, Georgetown, TX, 78628
Evelyne Barthélemy, , Ile de France, 78150
Kyle Treanor-Brown, Rainier, OR, 97048
Judy Strohmaier, Upper Marlboro, MD, 20772
Fra Fitzzz, Irvine, CA, 92604
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Satchel McKee, Eldorado, OH, 45321
R Daghighian, Foster City, CA, 94404
James Moran, Glendale, AZ, 85305
Alex Kowtun, Hornell, NY, 14843
Glenn Johnson, Houston, TX, 77004
Sarah Tuning, Berkeley, CA, 94704
Nan Dahringer, Adrian, MI, 49221
Deanna Johnson, Davis, CA, 95618
Shirley Stephenson, Gregory, MI, 48137
Nancy O'Byrne, Saint Augustine, FL, 32080
Zeye Vandeye, Tucson, AZ, 85745
Laura James, Mobile, AL, 36695

Julia Thollaug, Montara, CA, 94037
Teresa Neidich, Somerville, NJ, 08876
Ruth Correia, Elizabeth, NJ, 07208
Frank Spadazzi, Cranston, RI, 02921
Amanda Smith, Venice, FL, 34293
lawrence rieder, Henderson, NV, 89052
Joseph Malina, North Las Vegas, NV, 89031
Rhonda Parsons, Rockford, IL, 61114
Joshua Konheim Heffron, New York, NY, 10021
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A Linkous, Montgomery, TX, 77356
Thomas Bejgrowicz, Wadley, AL, 36276
Jean Hawkins, Dallas, TX, 75230
Clover Krajicek, Hodgkins, IL, 60525
Diana Baker, Las Vegas, NV, 89130
Nancy Goodspeed, Westbrook, ME, 04092
Lorraine Barrie, Kihei, HI, 96753
Jake Gutman, Pacific Palisades, CA, 90272
Richard Pross, Lake Oswego, OR, 97034
Chaz Heikkila, Champlin, MN, 55316
Laura D., Atlanta, GA, 30318
Susan OConnor, Cookeville, TN, 38506
S Doetsch, Charlottesville, VA, 22901
Wendy Yost, Syracuse, NY, 13207
Cami Conner, San Antonio, TX, 78261
Susan B O'Connor, Cookeville, TN, 38506
Paul Tippery, Decatur, NE, 68020
Gwyneth Nowack-Greene, Altoona, PA, 16602
LuAnn Giunta, Westport, CT, 06881
Cristina Moody, Washington, DC, 20019
Joselyn Wilkinson, Los Angeles, CA, 90045
P Gilbert, Sacramento, CA, 95821
Carol Reiche, Santa Barbara, CA, 93108
Eric Burr, Winthrop, WA, 98862
Maria Cecilia Correia, Elizabeth, NJ, 07201
J. Leithwood, , ON, L4G 7E8
Frank Marshalek, Bloomington, IN, 47404
Emanuel Johnson, Chicago, IL, 60613
Patricia Rodriguez Tillman, Somerville, AL, 35670
Lee B, Clayton, DE, 19938
Marc Imlay, Bryans Road, MD, 20616
Seth Mirsky, Westport Island, ME, 04578
Ross Glasser, Denver, CO, 80211
C Ortiz, Hackensack, NJ, 07601
gina nova, , ?eská republika, 12000
Maureen Harazin, Evanston, IL, 60202
Kevin b, Bloomington, IN, 47408
Daniel OBrien, Milton, NY, 12547
Sandy Schott, Kalispell, MT, 59901
C. Williams, Waco, TX, 76710
Daniela Powers, Penngrove, CA, 94951
Karen Tyrell, Phoenix, AZ, 85034
Maryellen Lewis, Minneapolis, MN, 55403
Shelley R, Mead, WA, 99021
Mary Hupp, Lexington, SC, 29072
Karen Lake, Spokane, WA, 99208
Russell Simpson, Las Vegas, NV, 89104
Sarah Leonard, Los Angeles, CA, 90036
Sabine Dahlhaus, , AK, 58849
Carole Jean, Portland, ME, 04102
Michael Bertrams, Oroville, CA, 95966
Lacey Gautreaux, Opelousas, LA, 70570
Jennifer Lowans, Fayetteville, PA, 17222
Stephen Meilenner, Madison, WI, 53703
Jse Prowse, Princeton Junction, NJ, 08550
Robin Davis, South Fork, CO, 81154
Elizabeth Hourican, Phoenix, AZ, 85015
NK A, Pompano Beach, FL, 33073
Peter Brezny, Asheville, NC, 28801
Gayle Smith, Carmel, CA, 93923
Jordan Fiskin, Newport Beach, CA, 92660
Kevin Banach, Middletown, CT, 06457
Jennifer Flood, , , HM 01
Anna Linsel, , , 76137
Linda Lewis, Venice, FL, 34285
Naomi W, Eagle, ID, 83616
Esteban Nada, New York, NY, 10003
Giuseppe Zolli, , , 85100
Alison Roxby, Seattle, WA, 98107
Jasha S, Santa Barbara, CA, 93108

Penny Goldman, Pompano Beach, FL, 33076
Ronald DeStefano, Mount Arlington, NJ, 07856
A J Hawkins, Richmond, VA, 23225
David Dragavon, Portland, OR, 97267
Tiffany McEachern, Temple, TX, 76504
Noel Bobilin, Volcano, HI, 96785
Lydia Kawaler, Clarence, NY, 14031
Doug Shohan, Lee, MA, 01238
Karen Prowda, Vestal, NY, 13851
Sarah Hanson, Friday Harbor, WA, 98250
Trina M.Keafer, Mesa, AZ, 85203
Ramsay Kieffer, Harrington, DE, 19952
Carol McLoughlin, Whitestone, NY, 11357
Devin Royer, Austin, TX, 78745
Regina Lester, Mullins, SC, 29574
Maryetta Pinn, Bealeton, VA, 22712
Laura M, , , 11121
Jennifer Jerlstrom, Buena Park, CA, 90620
Stephanie Zaientz, Glen Oaks, NY, 11004
Alexander Dugan, Roxbury, MA, 02119
richard Blake, Chelsea, MI, 48118
sandy goncarovs, Houston, TX, 77098
Marilyne Chenuet, , , 91940
Maxine A Goodyear, Belton, MO, 64012
Laura Z, Fullerton, CA, 92833
J Chepeska, Germanton, NC, 27019
Charles Wirth, Hurley, SD, 57036
Nancy Gathing, Madison, WI, 53714
Ryan Hanson, New Orleans, LA, 70115
K S, Charleston, WV, 25302
Tawny Reynolds, Berkeley, CA, 94702
Nisi Sands, Tucson, AZ, 85730
Corinne Martinell, Hillsboro, OR, 97123
Wm Briggs, Hermosa Beach, CA, 90254
Ryan Alexander, Reno, NV, 89509
M Murphy, Thornton, CO, 80241
Susan Momtague, Housatonic, MA, 01236
Andrea Thompson, Eufaula, OK, 74432
Patricia Peck, Niagara Falls, NY, 14304
Vikram Sikand, Weehawken, NJ, 07086
Paulette Kuziola, Butler, TN, 37640
Andrea Chin, Redmond, WA, 98052
Nicole F, Papaaloa, HI, 96780
Alton Cullen, Pasadena, CA, 91107
Cynthia Haller, Sanford, FL, 32771
Ann Eittinger, San Gabriel, CA, 91775
Jarrett Cloud, Stanhope, NJ, 07874
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Tina Johnson, Buckeye, AZ, 85396
Grog Kress, Salt Lake City, UT, 84121
Valerie Weiss, Kapaa, HI, 96746
Pat Copenhaver, Iowa Falls, IA, 50126
M Letellier, Petaluma, CA, 94952
Walter Kyes, Kalamazoo, MI, 49001
Joyce Coombs, Corryton, TN, 37721
Kirstie Carlyle, Ward, AR, 72176
Stephen Newman, Melbourne, FL, 32935
Ms Zentura, Casper, WY, 82609
Abigail Rizzo, Chico, CA, 95926
Ruth Provost, Exeter, ME, 04435
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Ariana Aronis, San Antonio, TX, 78210
Bärbel Bärbel, , Bayern, 93049
Miranda Daviduk, Corvallis, OR, 97330
K Pence, Lees Summit, MO, 64063
Jill Seiden, Englewood, NJ, 07631
D Norrell, Studio City, CA, 91604
Helen Garner, Anaheim, CA, 92805
David Wipper, Boise, ID, 83702
Allison Toth, Longmont, CO, 80501
Julie Anderson, Stevenson, WA, 98648
Annabelle Palacios, Mckinney, TX, 75071
david fuller, Newport, ME, 04953
Teresa Phillips, Fort Collins, CO, 80525
Andrew Trinidad, Bronx, NY, 10451
Joshua Reddinger, Sharpsville, PA, 16150
Della Patton, Marion, OH, 43302
Terry C., Aurora, CO, 80014
Kathryn Lawson, Cincinnati, OH, 45247
Richard Cianfarani, Romeo, MI, 48065
Michele Gribble, Havre de Grace, MD, 21078
Eleanor Ohnemus, Norfork, AR, 72658
John Havekotte, Vashon, WA, 98070
Jesse Ginsburg, New York, NY, 10040
Sanjay Kumar, New York, NY, 10040

Janie Ginsburg, Mashpee, MA, 02649
Larry Ginsburg, Mashpee, MA, 02649
Lila Ginsburg, Minneapolis, MN, 55422
Esther Zamora, Victorville, CA, 92392
Kenn Shields, Atlantic Beach, FL, 32233
Anne Pavlic, Northville, MI, 48167
Rick Scott, Angleton, TX, 77515
Richard Headley, Pittsburgh, PA, 15228
James Miller, Clinton, ME, 04927
Ann Denton, Sonora, CA, 95370
Marcia Lewis, Silver Spring, MD, 20904
Alexander Dolowitz, Salt Lake City, UT, 84121
John Coffey, Shortsville, NY, 14548
Roberto Martinez-Barcenas, Hesperia, CA, 92345
c. Roberts, Nashville, IN, 47448
Terry Eaton, Brush Prairie, WA, 98606
Joseph De Feo, Yonkers, NY, 10704
andrea fisher, Everett, WA, 98203
Kathie Rasmussen, Lawrence, KS, 66046
Lu Sands, Tucson, AZ, 85730
Thomas Lunney, Rochester, MN, 55901
John Pasqua, Escondido, CA, 92025
Samantha Greger, Folcroft, PA, 19032
Mary Zack, Columbus, OH, 43085
Anita Youabian, Los Angeles, CA, 90024
Stephen M Slivinsky, Brewster, NY, 10509
Francine Koehler, Neosho, MO, 64850
Cindy Shoaf, Salisbury, NC, 28146
Gregory Chandler Jr, Madison, AL, 35757
Annie Jackson, Donalsonville, GA, 39845
Linda Peddemors, Sidney, OH, 45365
Solomon Blecher, New York, NY, 10009
Jean Carter, Youngsville, NC, 27596
Cydney Siri, Cimarron, CO, 81220
Mark Koritz, Atlanta, GA, 30338
Sarada Cleary, Oceanside, CA, 92056
Jackson Green, Salt Lake City, UT, 84124
Vickie Richardson, Buford, GA, 30518
Angela Clayton, Vista, CA, 92081
Sandra Remilien, North Miami, FL, 33161
Linda Parkhurst, Raymond, NH, 03077
Amy Dambrosio, Ho Ho Kus, NJ, 07423
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Angelina Guzman Volpe, Boston, MA, 02114
Martha Adams, Bellows Falls, VT, 05101
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Susan Galante, Fuquay Varina, NC, 27526
Katherine Atchison, Fort Collins, CO, 80528
Kyla Mendozza, Commerce City, CO, 80022
Rita Cotting, , Zuerich, 08048
Magdalini Iordanidou, , , 54642
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Robyn Winder, Fremont, OH, 43420
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Barbara Franck, Philadelphia, PA, 19126
Tovya Wager, Belvedere Tiburon, CA, 94920
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andy holloway, Brooklyn, NY, 11207
Keith Olson, New Milford, CT, 06776
Marcia Reiter, Saint Paul, MN, 55129
Grace Green, Laguna Niguel, CA, 92677
c o, New York, NY, 10025
Mariel Huck, Charleston, SC, 29407
E. Neal, Cape May Court House, NJ, 08210
Gabbie DiNardi, Centerville, MA, 02632
Barbara Rosen, Providence, RI, 02906
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Mia Kraft, Akron, OH, 44312
Abbot Foote, Dublin, NH, 03444
Virginia Lyons, Suffield, CT, 06078
Janet Hendrick, Pollocksville, NC, 28573
Roger Sothward, Placitas, NM, 87043
Lindsay L, Bristol, RI, 02809
Olga Ros Lozano, , , 08901
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June Mathis, Wakefield, VA, 23888
Michael Harris, Burlington, NJ, 08016
Carl Huenefeld, Tulsa, OK, 74137
Caitlin Barnett, Toano, VA, 23168
Larry East, Tucson, AZ, 85743
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Anna Littman, Barnardsville, NC, 28709
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Kyle Cornish, Brooklyn, NY, 11216
S. Kay, Tijeras, NM, 87059
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Brandon Anyzeski, Knoxville, TN, 37919
John Taylor, Collierville, TN, 38017
Kyle Numann, Nashville, TN, 37207
Chris Dotson, Knoxville, TN, 37923
Maria Dotson, Knoxville, TN, 37923
Amanda Dotson, Knoxville, TN, 37917
Thomas Chandler, Portland, TN, 37148
Jesse Farber-Eger, Nashville, TN, 37206
Kyle McAllister, Nashville, TN, 37210
Emily Hamilton, Knoxville, TN, 37938
Jake Denton, Knoxville, TN, 37909
Christopher Rollins, Knoxville, TN, 37917
jonathan ling, Madison, TN, 37115
Blake Wright, Chattanooga, TN, 37404
Alex Wiederspahn, Knoxville, TN, 37920
Caroline Landis, Hixson, TN, 37343
Mykaela Tackett, Rocky Top, TN, 37769
Jake Brown, Chattanooga, TN, 37404
Derrick Painter, Chattanooga, TN, 37411
Leif Hietala, Norris, TN, 37828
Henry Holmes, Knoxville, TN, 37909
Quay Morgan, Cleveland, TN, 37323
Zachary Parrish, Hixson, TN, 37343
Laurin Finney, Rockford, TN, 37853
Dave Jarjoura, Marshall, NC, 28753
Robert Tyson, Savannah, GA, 31420
Veronica Blake, Port Huron, MI, 48060
Rene Walkup, Charleston, SC, 29407
Debra Mot, Clio, MI, 48420
Hayley Green, Memphis, TN, 38117
David Forkel, Troy, NY, 12180
ELIZABETH WELLER, Antioch, TN, 37013
joyce niksic, Hammond, IN, 46323
S Mumford, Schenectady, NY, 12345
Mo Attar, Berkeley Springs, WV, 25411
Carol Southland, Spring Lake, MI, 49456
Donald McClellan, Madera, CA, 93636
Savannah Pflueger, Mount Juliet, TN, 37122
Musgrove Tracy, Lubbock, TX, 79415
Alexandra Vanderput, Mountain View, CA, 94040
Meg Green, Scott Depot, WV, 25560
Fischer Fischer, Roanoke, VA, 24018
Stephanie Esparza, Phoenix, AZ, 85042
Rachel Schafler, Floral Park, NY, 11001
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Nancy Benner, Belding, MI, 48809
Kathleen Wahl, Berlin, NJ, 08009
Desikan Rajagopalan, Saint Charles, MO, 63303
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Ruby Richmond, Brentwood, TN, 37027
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CONELIA Bernstein, Glen Allen, VA, 23059
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JUDITH OTOOLE, Venice, FL, 34293
Margaret Elliott, Franklin, MI, 48025
Voncille Henry, Tucson, AZ, 85712
Eli Ginsburg, Merritt Island, FL, 32952
Lindy Dubois, Encino, CA, 91316
Gretchen WLtemire, Charleston, SC, 29412
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Kristin Andersen, San Rafael, CA, 94903
Jaimi Smiley, Flagstaff, AZ, 86004
Sheryl and David Armijo and Roller, Albuquerque, NM, 87110
Sheila Pereira, Colorado Springs, CO, 80907

Kim Nguyen, Houston, TX, 77043
John Asvestas, Huntington, NY, 11743
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Marcie Clutter, Inverness, FL, 34453
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Dana Atnip, Ferndale, MI, 48220
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From: Gil Hough
To: Integrated Resource Plan; nepa
Cc:
Subject: 2024 TVA Integrated Resource Plan (IRP) scoping comments from TenneSEIA
Date: Monday, July 3, 2023 1:26:43 PM
Attachments: TVA 2024 IRP Scoping Comments TenneSEIA 07.032023.pdf
Attachment A Real-Reliability-The-Value-of-Virtual-Power 5.3.2023.pdf

Dear Hunter Reed and Kelly Baxter,

TenneSEIA (Tennessee Solar Energy Industries Association) appreciates the opportunity to provide input on the scope of the 2024 TVA IRP. Meaningful engagement with stakeholders across the Tennessee Valley is a critical component of successful resource planning. Please see the attached documents for our full comments.

The purpose of the IRP is to determine how TVA can continue to provide low-cost, reliable electricity, support environmental stewardship, and spur economic development in the Valley; we believe there is no better way to accomplish this than for TVA to embrace solar, battery storage, and other renewable and advanced energy technologies.

Tennessee Valley Authority (TVA)'s 2024 Integrated Resource Plan (IRP) Scope should:

- Include strong Distributed Generation (DG) programs which enhance grid reliability and allow for more rapid deployment of renewable generation.
- Consider proactive transmission planning to unlock renewables in the highest-value areas of TVA's footprint and build IRP models that consider lowest cost transmission planning that does not create arbitrary caps on renewable expansion based on current transmission constraints.
- Consider areas of business process improvement and support a robust stakeholder process to resolve these current challenges, which is slowing renewable deployment, in the near term. TVA should not include any arbitrary caps on new renewable resources, either annual deployment or cumulative deployment.
- Treat BESS (Battery Energy Storage System) as a resource capacity and a reliability asset.
- Ensure it is best utilizing and optimizing the multiple new tax incentives provided under the Inflation Reduction Act, to decrease the cost of renewables and expand the deployment of solar and storage in the Valley.

Thank you,
--
Gil Hough

Executive Director

www.tenneSEIAsolar.com

"Our mission is to promote the development of solar energy and complementary technologies, including storage, positioning the Tennessee Valley's residents and businesses as leaders in clean energy deployment and economic development."

State Affiliates Co-Representative, Board of Directors
SEIA (Solar Energy Industries Association)

Real Reliability
The Value of Virtual Power

PREPARED BY
Ryan Hledik
Kate Peters

VOLUME I: SUMMARY REPORT

MAY 2023

Brattle

Notice

PLEASE NOTE

This report was prepared by The Brattle Group for Google. It is intended to be read and used as a whole and not in parts. The report reflects the analyses and opinions of the authors and does not necessarily reflect those of The Brattle Group's clients or other consultants.

We would like to thank Keven Brough and Rizwan Naveed of Google for the invaluable project management, insights, and data that they provided throughout the development of this report. We also are grateful for the modeling contributions of our Brattle colleague, Adam Bigelow.

Contents

Summary

Overview

Maintaining power system resource adequacy is a major investment.

Over the past decade, the U.S. added over 100 GW of new capacity intended largely to maintain resource adequacy. This amounted to over $120 billion of capital investment, primarily in gas-fired generators and lithium-ion batteries.

Virtual Power Plants (VPPs) are an emerging alternative to conventional resource adequacy options.

A VPP is a portfolio of actively controlled distributed energy resources (DERs). Operation of the DERs is optimized to provide benefits to the power system, consumers, and the environment. Within a decade, analysts forecast an inflection point in the trajectory of DER ownership. VPPs already are beginning to be deployed across the U.S. and internationally.

We explore the ability of VPPs to reliably reduce resource adequacy costs in the coming decade.

We model the economics of a residential VPP for a representative U.S. utility system in 2030. The utility system is 50% renewables, with both summer and winter resource adequacy needs. The VPP in our study is composed of commercially available residential load flexibility technologies. VPP operations are based on actual observed performance of DERs, accounting for operational and behavioral constraints. The net cost of providing resource adequacy from the VPP is compared to that of a gas peaker and utility-scale battery. Net cost accounts for additional value from energy, ancillary services T&D deferral, resilience, and greenhouse gas (GHG) emissions.

Key Findings

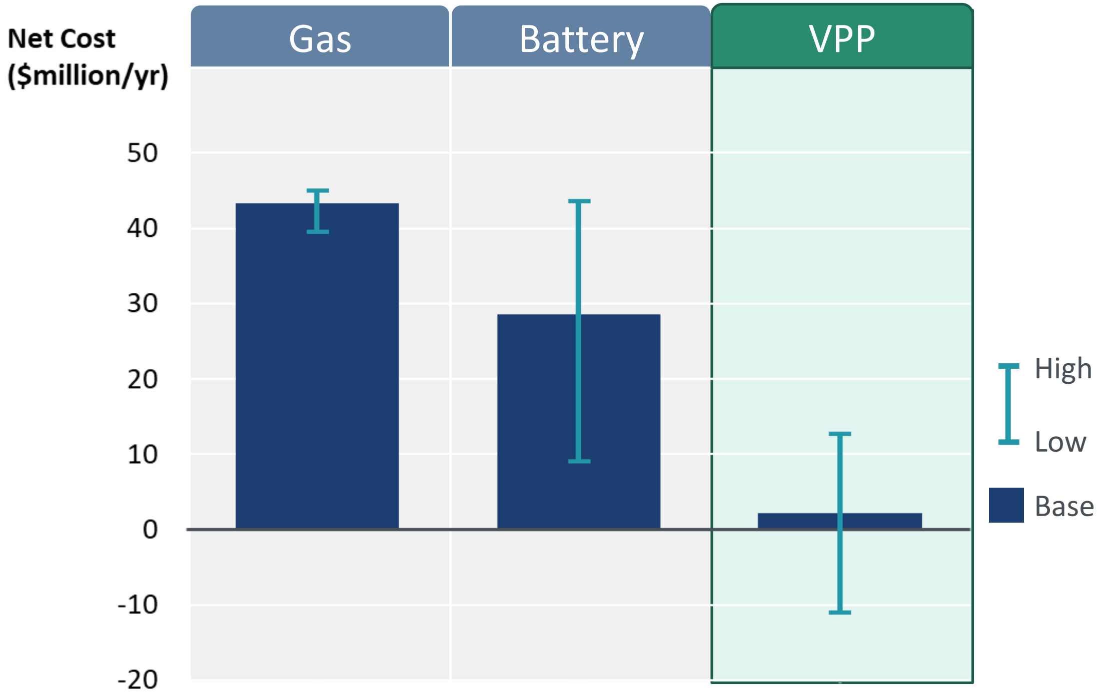
Real reliability: A VPP that leverages residential load flexibility could perform as reliably as conventional resources and contribute to resource adequacy at a similar scale.

Cost savings: Excluding societal benefits (i.e., emissions and resilience), the net cost to the utility of providing resource adequacy from the VPP is only roughly 40% to 60% of the cost of the alternative options. Extrapolating from this observation, a 60 GW VPP deployment could meet future resource adequacy needs at a net cost that is $15 billion to $35 billion lower than the cost of the alternative options over the ensuing decade (undiscounted 2022 dollars).

Additional benefits: When accounting for additional societal benefits, the VPP is the only resource with the potential to provide resource adequacy at negative net cost. 60 GW of VPP could provide over $20 billion in additional societal benefits over a 10-year period.

More work is needed: Key barriers must be addressed to fully unlock this value for consumers and ensure that virtual power plants become more than just virtual reality.

Net Cost of Providing 400 MW of Resource Adequacy
(Range observed across all sensitivity cases)



Note: Costs shown in 2022 dollars. Costs are net of societal benefits (i.e., GHG emissions avoidance and resilience value) and power system benefits (energy, ancillary services, and T&D deferral value).

An Introduction to VPPs

Introduction

Over 100 GW of capacity was built primarily to provide resource adequacy in the U.S. in the past decade, requiring over $120 billion of investment. More will be needed.

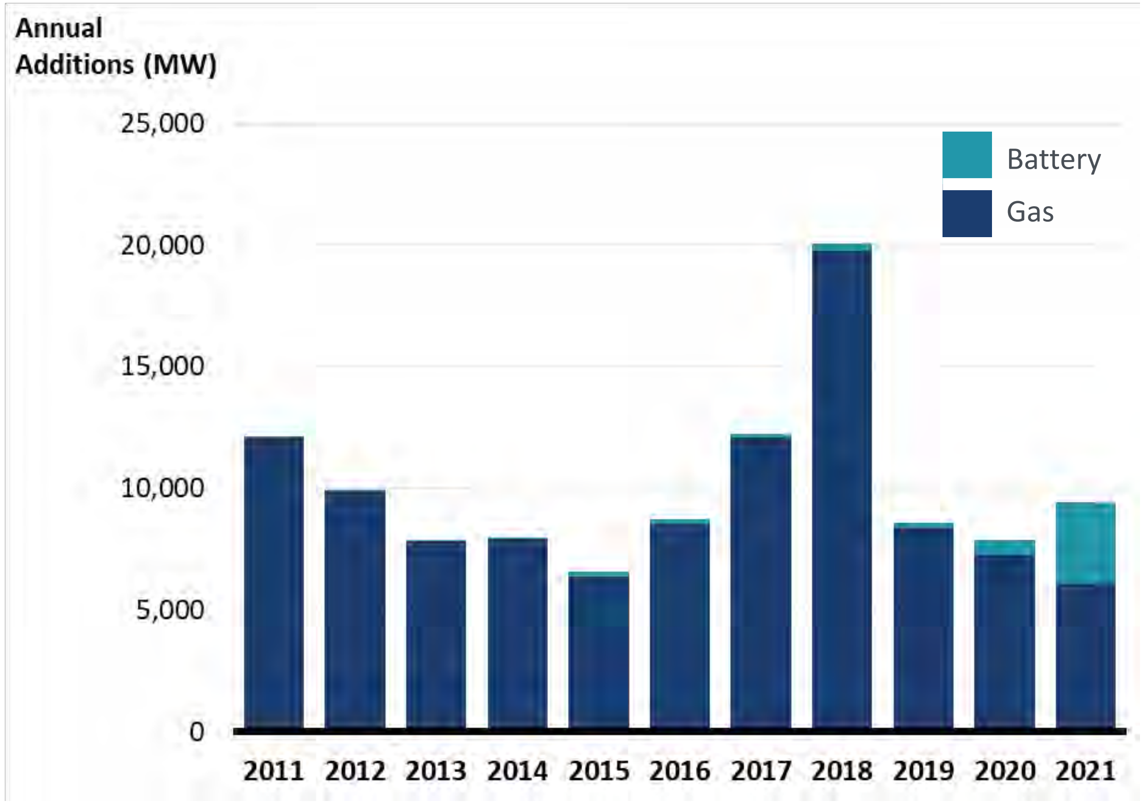
Providing affordable system reliability is the primary objective of utilities and regulators as they make generation resource investment decisions.

Electrification, coal retirements, and dependence on resources with limited capacity value (wind, solar) will continue to result in a persistent need to maintain sufficient system "resource adequacy" by adding new dispatchable capacity.

Historically, natural gas-fired combustion turbines and combined cycles have served this need. Increasingly, utility-scale battery storage is being deployed for the same reason.

Alternatively, in this study we explore the cost of serving resource adequacy needs from an emerging resource: a virtual power plant (VPP).

Historical U.S. Capacity Additions for Resource Adequacy
~110 GW, 2012-2021



Sources: EIA, Velocity Suite ABB Inc, and NREL.
Note: $120 billion estimate assumes 110 GW at an average installed cost of approximately $1,100/kW in 2022 dollars. "Gas" includes combustion turbines and combined cycles that have been built for a combination of resource adequacy and energy value.

What Is a VPP?

A VPP is portfolio of distributed energy resources (DERs) that are actively controlled to provide benefits to the power system, consumers, and the environment.

Virtual Power Plant

Examples of potential elements

- Smart thermostats
- Rooftop solar PV
- Electric vehicles (EVs)
- Distributed batteries
- Smart water heaters
- Commercial building automation systems

Note: VPPs can be composed of many distributed technologies. As described later, the VPP modeled in this study is composed of a subset of the options shown here.

1 Customers allow their DERs to be directly managed – subject to operational constraints – by an aggregator or electric utility.

Aggregator or utility with distributed energy resource management system (DERMS)

2 Utilities and aggregators manage the DERs in an orchestrated way to provide grid benefits (e.g., reducing demand during peak load hours to avoid investment in conventional generation capacity).

Power system (distribution grid, transmission grid, power generation)

3 The power system is expanded and operated at a lower total cost, reliability is maintained, and emissions are reduced.

4 The cost savings provided by the VPP are shared between the individual participants, the aggregator, the utility, and society broadly.

An Inflection Point for VPP Deployment

DER ownership is expected to grow by several multiples within the next decade in the United States.

Several forces currently are driving VPP deployment to an inflection point:

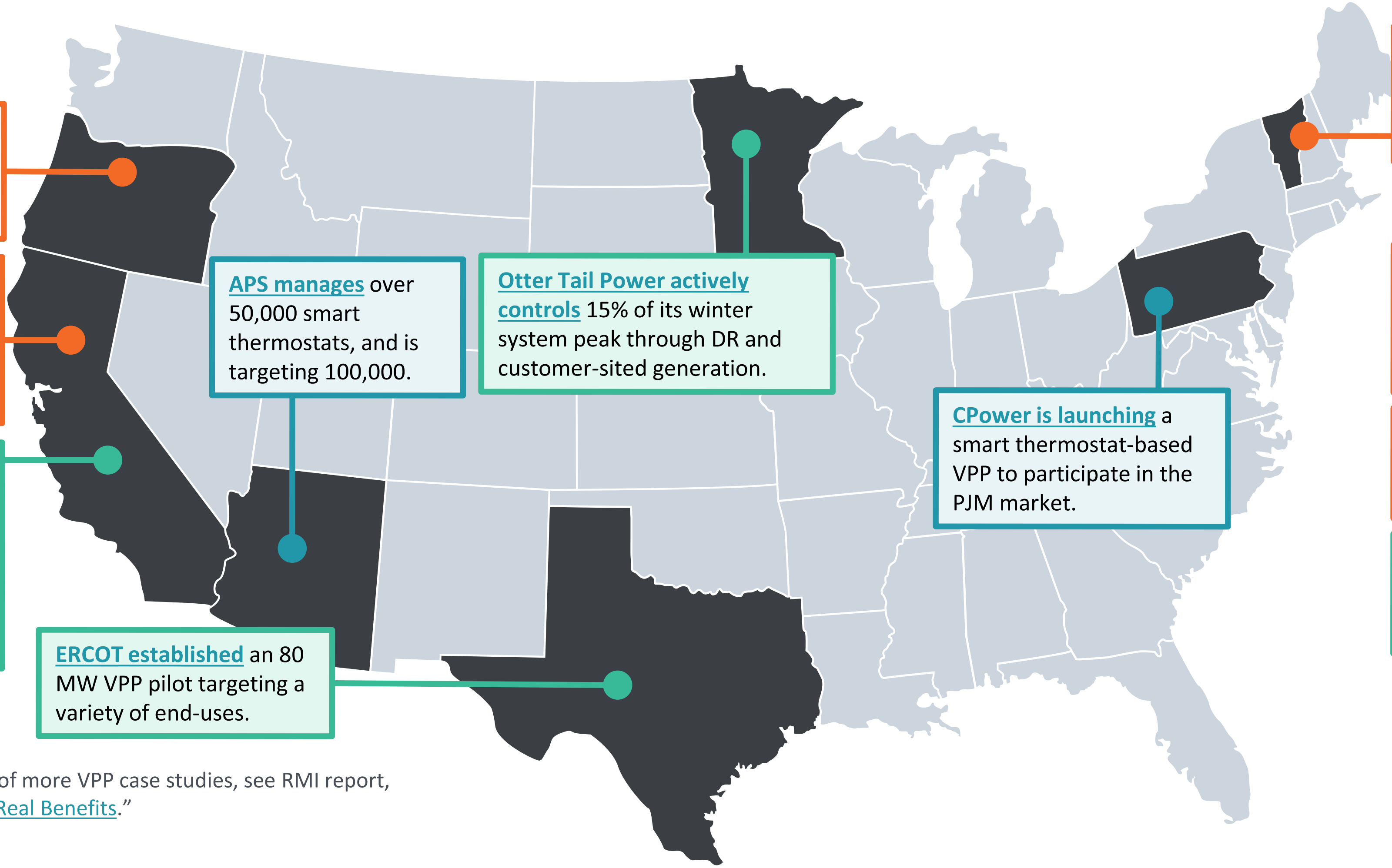
- **Declining DER costs**, particularly EVs and batteries
- **Technological advancement** in algorithms for managing and optimizing the value of DERs
- **Inflation Reduction Act (IRA) incentives** to promote electrification and efficiency
- **FERC Order 2222** and accompanying initiatives to open wholesale markets to VPP participation
- **Growing model availability** of EVs, thermostats, smart panels, and others
- **The decarbonization imperative**, a focus of policymakers, utilities, and consumers

	PRESENT	2030
Homes with Smart Thermostats	10%	34%
Homes with Electric Water Heating	49%	50%
Residential Rooftop Solar	27 GW	83 GW
Behind-the-Meter (BTM) Batteries	2 GW	27 GW
Light-Duty Electric Vehicles	3 mil.	26 mil.

Notes: See technical appendix for details. Modest growth in electric water heating is due to significant existing market saturation and near-term focus of the adoption forecast. The Inflation Reduction Act may further accelerate these adoption forecasts.

Real-World VPPs

To a degree, VPPs have existed for decades as demand response programs. But VPPs are rapidly evolving to leverage the expanding mix of DER technologies.



PGE is launching a ~4 MW BTM battery VPP involving over 500 customers.

PG&E is developing a 30 MW solar-plus-storage VPP to address its summer net peak demand.

SCE has launched two VPP projects, one focused on 20 MWh of BTM storage and a second to procure 14 MW of DR.

APS manages over 50,000 smart thermostats, and is targeting 100,000.

Otter Tail Power actively controls 15% of its winter system peak through DR and customer-sited generation.

ERCOT established an 80 MW VPP pilot targeting a variety of end-uses.

CPower is launching a smart thermostat-based VPP to participate in the PJM market.

Green Mountain Power has enrolled more than 4,000 BTM batteries in its VPP and plans to expand the capacity of the program to 55 MW.

Hawaii: HECO will deploy an 80 MW VPP, composed primarily of solar-powered BTM batteries across 6,000 homes.

Australia: Tesla is developing a 250 MW / 650 MWh VPP involving up to 50,000 homes in South Australia.

Europe: Next Kraftwerke claims to have over 11 GW of resources managed through its VPP portfolio.

Smart thermostats

Solar/storage

Mix of DERs

Note: For descriptions of more VPP case studies, see RMI report, "Virtual Power Plants, Real Benefits."

Modeling VPP Performance

The VPP Modeled in This Study

VPPs can be composed of a variety of technologies.

In this study, we focus on commercially-proven residential demand response applications.

The term "VPP" often is associated with aggregations of behind-the-meter (BTM) solar and storage. However, a VPP can be composed of a much broader range of technologies.

In fact, a VPP does not even need to generate power. Dispatchable demand response (DR), enabled by technologies such as smart thermostats and electric vehicles (EVs), can provide many of the same benefits as distributed generation resources by reducing or shifting load.

Composition of the VPP modeled in this study

Smart Thermostats
A/C and electric heating are controlled to reduce usage during peak times. Customer comfort is managed through pre-cooling/heating.

Smart Water Heating
Electric water heaters act as a grid-interactive thermal battery, providing daily load shifting and even real-time grid balancing.

Home EV Managed Charging
EV charging is a large, flexible source of load that can be shifted overnight.

BTM Battery Demand Response
Customer-sited batteries can be charged and discharged to provide services to the grid for a limited number of events, while providing resilience as backup generation during all other hours.

Analysis Approach Overview

We compare the net cost of providing 400 MW of resource adequacy from three resource types: a natural gas peaker, a transmission-connected utility-scale battery, and a VPP. Our methodology is illustrated below.

1. Define utility system

The prototypical U.S. utility is defined using publicly available data.

We conservatively assume operationally challenging conditions for a VPP.

2. Establish system resource adequacy need

Each resource must provide 400 MW of resource adequacy. This is approximately 7% of the gross system peak for the illustrative utility.

3. Determine MW of each resource type needed

Each resource must be available with sufficient generation or load reduction capability during the top system net load hours of the year.

4. Estimate total cost of each resource type

The all-in cost of each resource type includes CapEx, fuel, and ongoing program costs, and is sourced from publicly available data.

5. Simulate market value of each resource type

We use Brattle's LoadFlex and bSTORE models to simulate the additional (i.e., non-resource adequacy) value that could be provided by each resource.

6. Calculate net cost of each resource type

The value of each resource is subtracted from its all-in cost to arrive an estimate of the net cost of providing 400 MW of resource adequacy from each resource type.

Note: See technical appendix for a complete description of modeling assumptions and data sources.

The Illustrative Utility System

We model an illustrative mid-size utility with 400 MW of new resource adequacy need (7% of gross system peak demand).

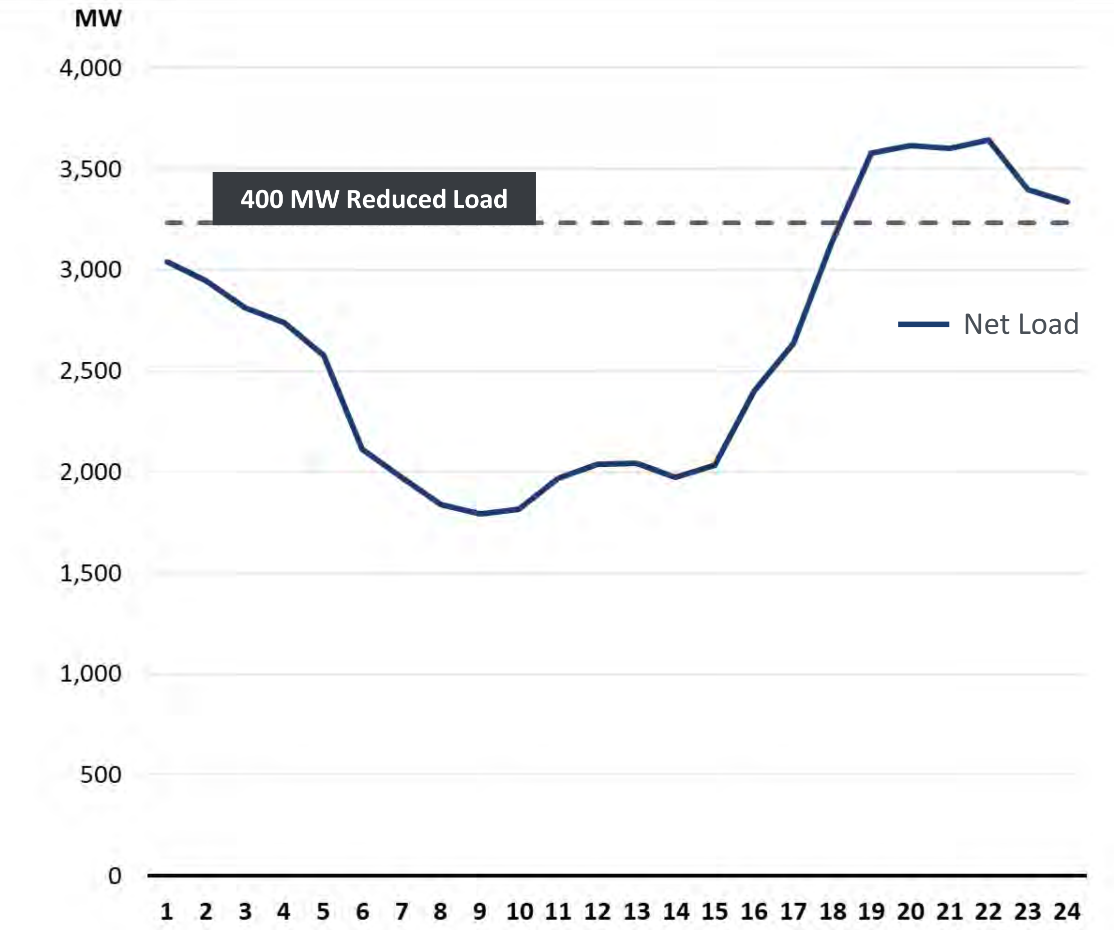
It includes a customer base of 1.7 million residential customers. Other factors in our illustrative utility include:

- 5,700 MW gross peak demand, 3,600 MW peak demand net of expected wind and solar generation
- Power generation is 50% renewable by 2030 (¼ solar, ¾ onshore wind), representing a growing trend toward decarbonized power supply

The illustrative utility is conservatively selected to represent challenging performance requirements for a VPP, such as a need for resource adequacy performance during many hours in both summer and winter

Data on marginal costs, hourly system load, renewable profiles, and customer characteristics are derived from sources such as NREL, EIA, and the U.S. Department of Energy.

Hourly System Net Load on Example Peak Day



Note: See technical appendix for a complete description of modeling assumptions and data sources.

Defining Resource Adequacy

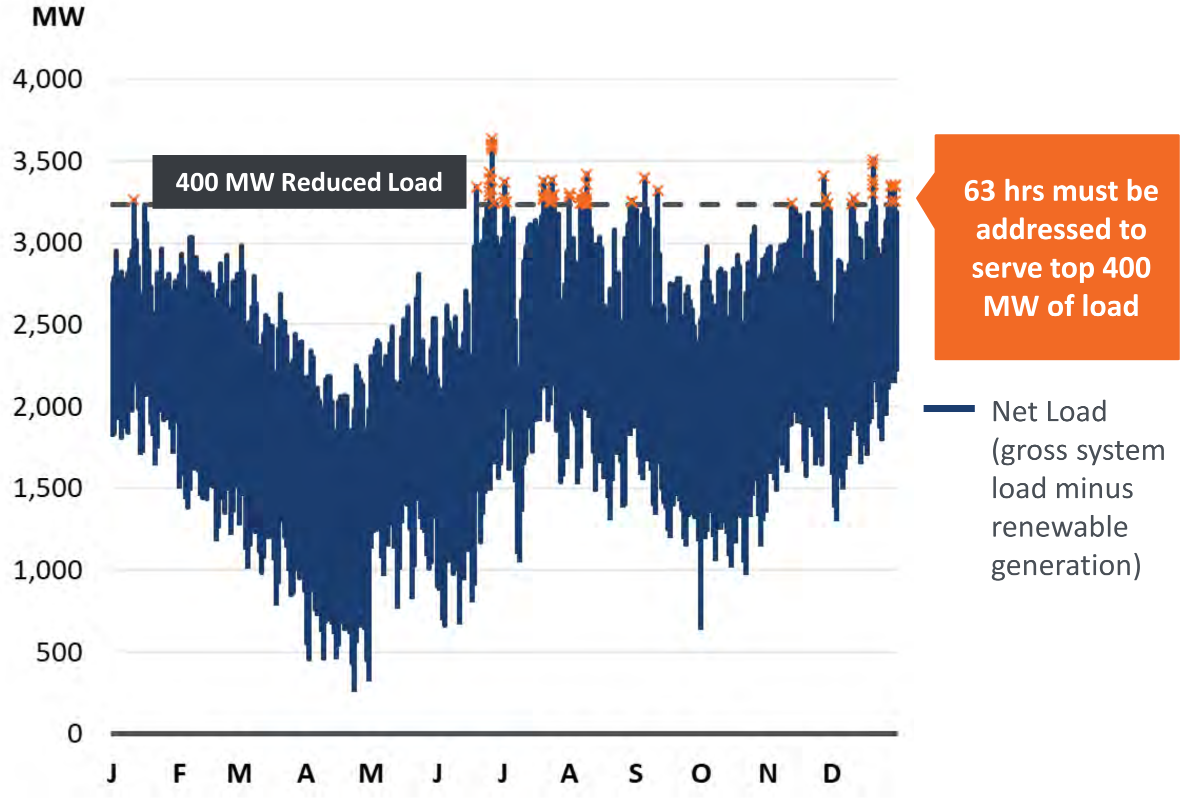
We conduct an hourly reliability assessment to ensure that all three modeled resource types are capable of fully providing 400 MW of resource adequacy to the utility system.

As a proxy for resource adequacy performance requirements, we require that the three resource options each be available to serve all load contributing to the utility's top 400 MW of net peak demand over an entire year (see figure at right).

This means that the resources must be available to perform at the required level for 63 hours of the year, spanning both summer and winter seasons.

One particular summer peak day in our analysis requires resource performance during seven consecutive hours.

Utility Hourly Net Load Profile



Note: See technical appendix for a complete description of modeling assumptions and data sources.

Calculating the Net Cost of Resource Adequacy

Our analysis estimates the cost of providing resource adequacy from each of the three resource types, net of any additional value those resources provide to the system and to society. The result is the "net cost" of providing resource adequacy.

Cost of installing and operating resource

CapEx

Fuel

Operations & Maintenance (O&M)

Program costs

–

System value of resource[1]

Energy value

T&D investment deferral

Ancillary services value

–

Societal value of resource[1,2]

GHG emissions reduction

Resilience value

=

Net cost of resource adequacy

Notes:
[1] Negative "value" indicates that the resource increases cost (e.g., a gas peaker increasing GHG emissions).
[2] Excluding societal value from the calculation results in an estimate of the net resource cost from the perspective of the utility or system operator.

Estimating Additional Market Value

The distributed nature of VPPs allows them to provide a broader range of system benefits than transmission-connected alternatives.

System Impact	Description	Gas Peaker	Utility-Scale Battery	VPP
Energy	Net change in system fuel and variable O&M costs due to the addition of the new resource.	+	+	+
Ancillary Services	Value associated with operating the resource to provide real-time balancing services to the grid.	+	+	+
Emissions	Net change in greenhouse gas (GHG) emissions due to the addition of the resource, valued at a social cost of carbon estimate of $100/metric ton.	–	–	+
T&D Investment Deferral	Deferred cost of investing in the transmission and distribution grid due to strategic siting of distributed resources.	N/A	N/A	+
Resilience	Avoided distribution outage associated with using DERs as backup generation.	N/A	N/A	+

+ = system benefit – = system cost

Notes:
Further discussion provided in next section.
Throughout the presentation, “utility-scale battery” refers to transmission-connected lithium-ion batteries.

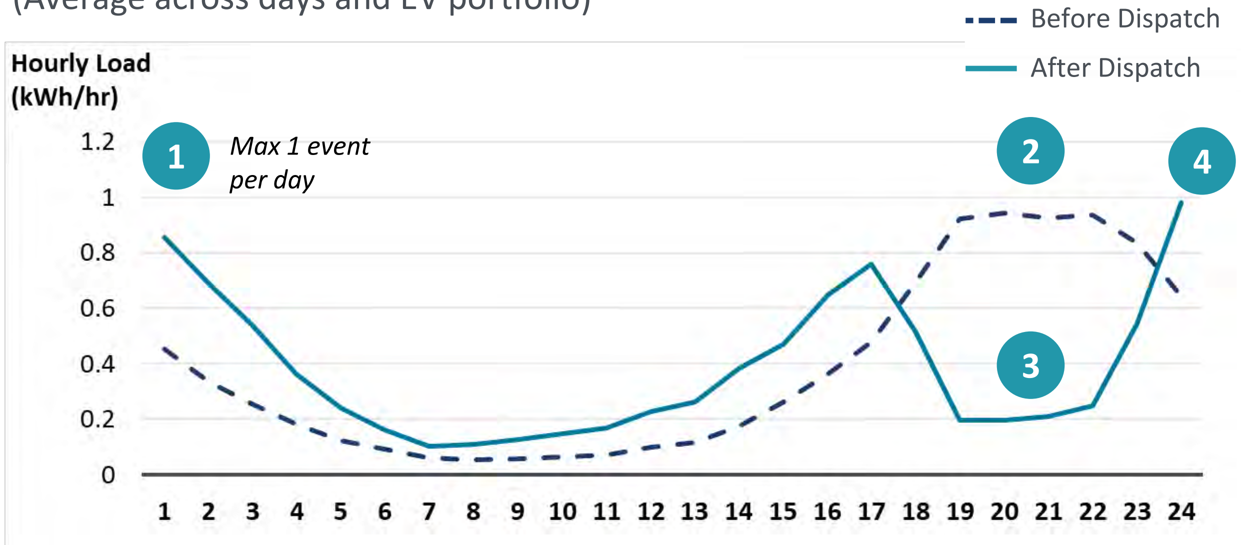
Modeling Realistic VPP Operations

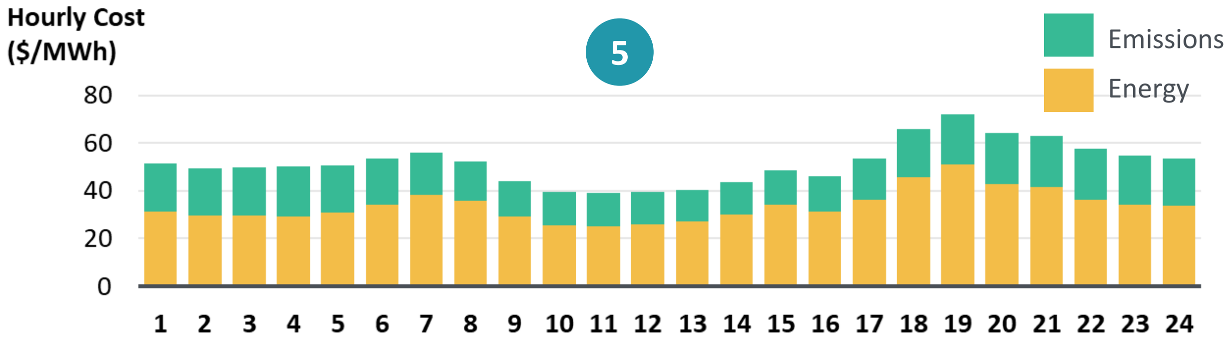
We simulate VPP dispatch to account for real-world operational limitations, based on observed performance in actual deployments.

1. Limits on customer tolerance for number of interruptions
2. Load impacts limited to actual available load during system peak hours
3. Load impacts account for event opt-outs, remain within customer tolerance range
4. Pre- and post-event load building to ensure customer usage ability
5. Dispatch is simulated to maximize avoided power system costs, in addition to providing resource adequacy

EV Home Charging Load Profile Relative to Hourly System Costs

(Average across days and EV portfolio)





Note: Dispatch and costs are shown as averages across event days. See technical appendix for a compete description of modeling assumptions and data sources.

Defining the VPP

The VPP modeled for this study is composed of load flexibility from four home energy technologies.

This is just one of many potential configurations of VPPs. Eligibility reflects potential technology adoption within the next decade. We assume achievable levels of customer participation in each component of the VPP.

Modeled costs are those that would be incurred by the utility. Costs are based on market studies, review of actual deployments, and expert interviews.

Note: Controllable demand sums to more than 400 MW across technologies to ensure sufficient capacity is available during all hours required for resource adequacy. Costs shown in 2022$. Smart water heating is the only option modeled as providing ancillary services (modeled as spinning reserves), as this is an existing commercial offering from grid-interactive electric resistance water heaters in PJM and other markets.

	Smart Thermostat DR	Smart Water Heating	Home Managed EV Charging	BTM Battery DR
Eligibility (% of residential customer base)	67% summer; 35% winter	50%	15%	1%
Participation (% of eligible customers)	30%	30%	40%	20%
Total Controllable Demand at Peak (MW)	204 MW	114 MW	79 MW	26 MW
Participation Incentive ($ per participant per year)	$25 per season	$30	$100	$500
Other Implementation Costs, including marketing and DERMS ($ per participant per year)	$43	$55	$80	$140
VPP Operational Constraints	15 five-hour events per season, plus 100 hrs of minor setpoint adjustments per year	Daily load shifting of water heating load, ancillary services	Daily load shifting of vehicle charging load	15 demand response events per year

The Value of VPPs

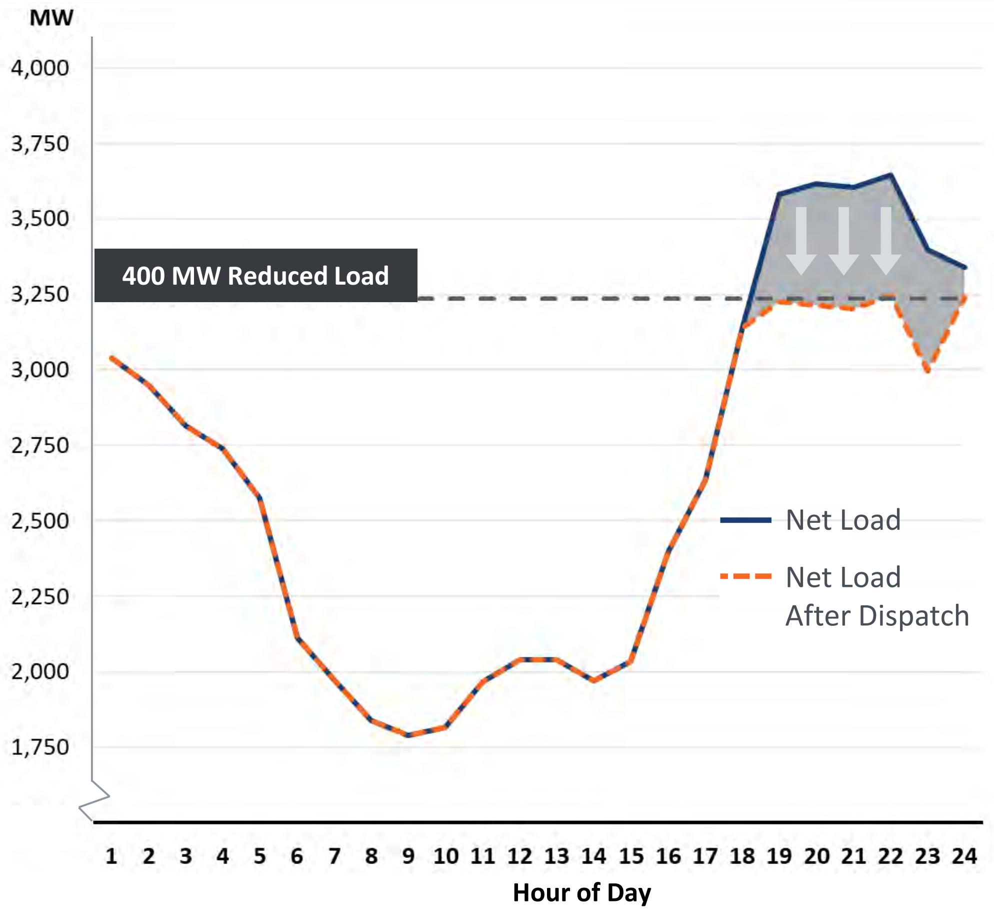
Gas Peaker Operations

The gas peaker provides resource adequacy by being available to generate when needed for system reliability reasons.

	System Impact	Discussion
Energy	➕	The peaker runs in any hour when its variable cost is lower than that of the marginal resource (or the energy price in wholesale energy markets)
Ancillary Services	➕	The peaker quickly ramps up and down in real-time to balance the grid
Emissions	➖	When the peaker runs, it burns natural gas and emits GHGs but also displaces emissions from the marginal unit
T&D Investment Deferral	N/A	Not a distributed resource
Resilience	N/A	Not a distributed resource

➕ = system benefit ➖ = system cost

Peak Net Load Day



Note: We assume that 440 MW of gas peaker capacity needs to be built in order to account for an expected forced outage rate of 10%.

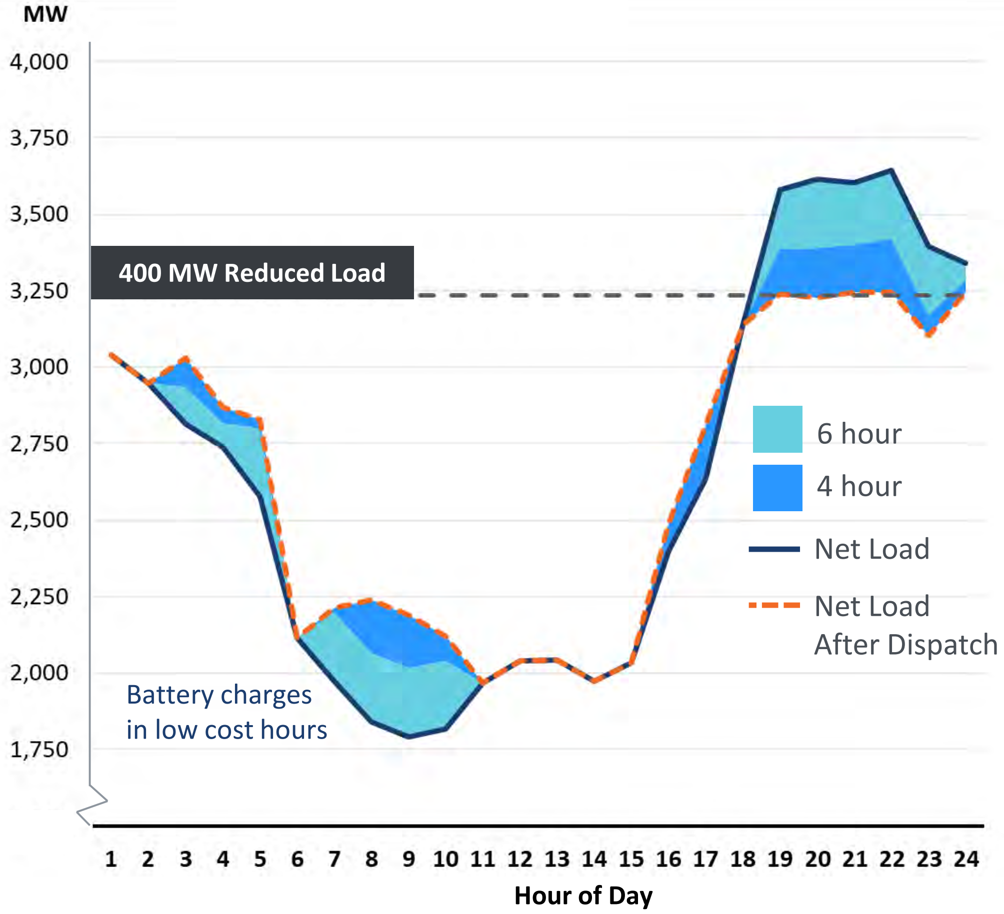
Utility-Scale Battery Operations

Batteries provide resource adequacy by charging during low cost hours and being available to discharge when needed for system reliability.

	System Impact	Discussion
Energy	+	The battery charges during the lowest cost hours of the day, and discharges during the highest cost hours of the day, displacing higher cost units
Ancillary Services	+	Batteries have the flexibility to quickly ramp up and down in real-time to balance the grid
Emissions	–	In our simulations batteries slightly increase GHG emissions, primarily because they consume more energy than they discharge (i.e., due to roundtrip losses)
T&D investment deferral	N/A	Not a distributed resource
Resilience	N/A	Not a distributed resource

+ = system benefit – = system cost

Peak Net Load Day



Note: We model a portfolio of 4-hour and 6-hour batteries; there are days when more than 4 hours of energy discharge is needed to provide full resource adequacy.

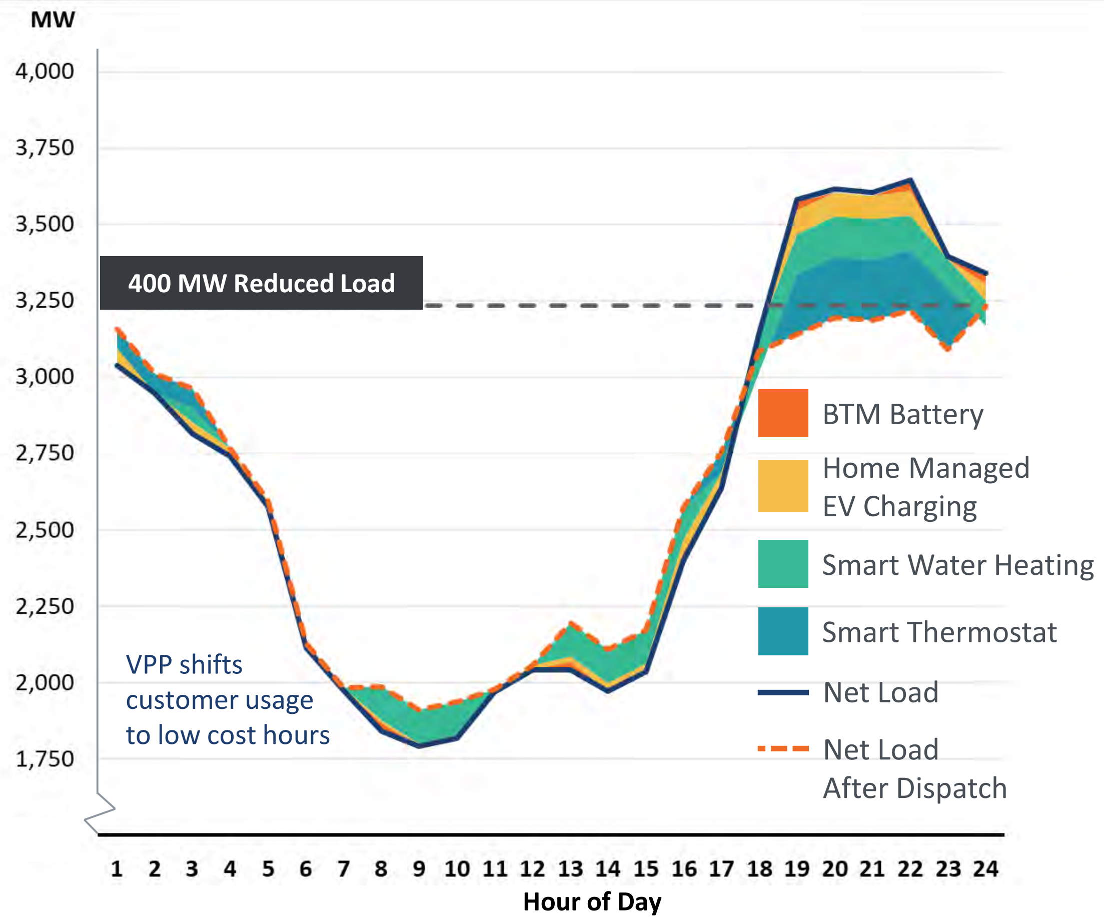
VPP Operations

The modeled VPP can fully provide 400 MW of resource adequacy, curtailing load across multiple hours of the day during summer and winter.

	System Impact	Discussion
Energy	+	The VPP curtails load during the highest cost hours of the day, and shifts load to lower hours
Ancillary Services	+	The heating element of smart electric water heaters can be managed to provide ancillary services
Emissions	+	The VPP reduces GHG emissions through an overall reduction in electricity consumption due primarily to the energy efficiency benefits of the smart thermostat
T&D Investment Deferral	+	Reductions in demand will delay the need for peak-related capacity upgrades to the T&D system
Resilience	+	Behind-the-meter batteries provide backup generation during distribution outages

+ = system benefit — = system cost

Peak Net Load Day

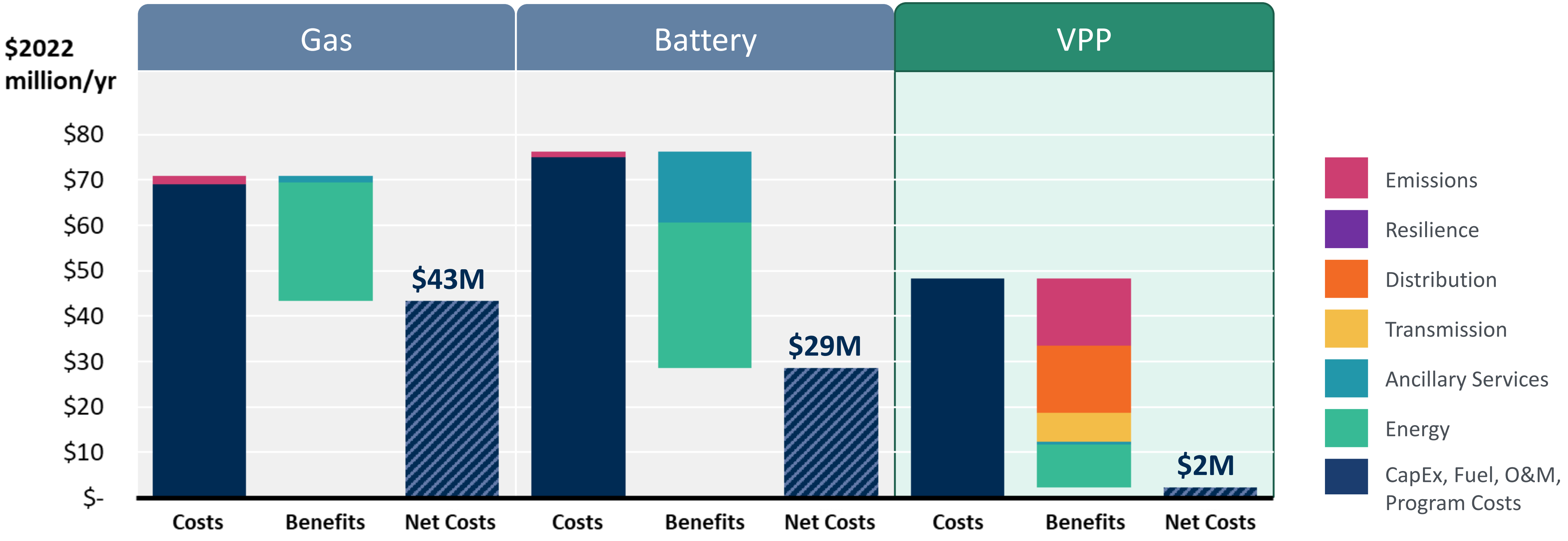


Brattle

Resource Adequacy… For Cheap

The VPP could provide the same resource adequacy at a significant cost discount relative to the alternatives.

Annualized Net Cost of Providing 400 MW of Resource Adequacy



The Cost of 60 GW of U.S. Resource Adequacy

VPPs could save U.S. utilities $15 to $35 billion in capacity investment over 10 years.

Focusing only on utility system costs and benefits, and ignoring societal benefits (i.e., emissions, resilience), the VPP could provide resource adequacy at a net utility system cost that is only roughly 40% of the net cost of a gas peaker, and 60% of the net cost of a battery.

According to RMI, 60 GW of VPPs could be deployed in the U.S. by 2030. Extrapolating from the findings for our illustrative utility, a 60 GW VPP deployment could meet future resource adequacy needs at a net cost that is $15 billion to $35 billion lower than the cost of the alternative options over the ensuing decade.

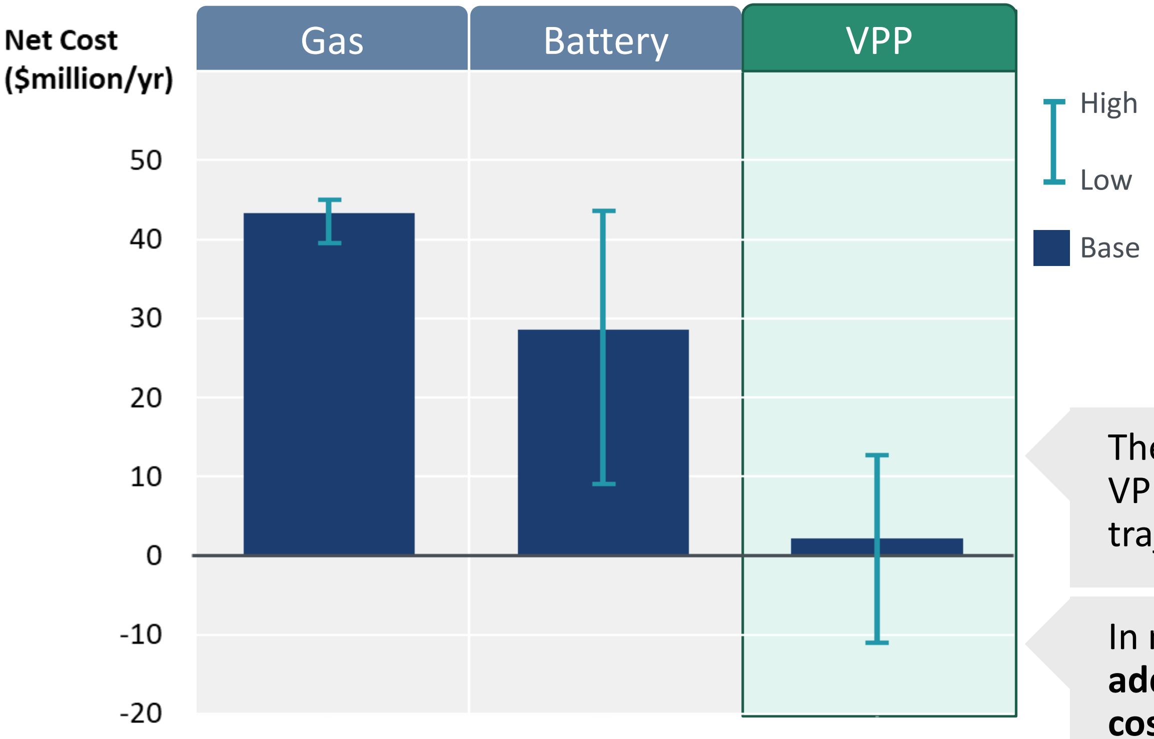
Decarbonization and resilience benefits are incremental to those resource cost savings. Consumers would experience an additional $20 billion in societal benefits over that 10-year period.

Notes: Assumes 60 GW of resource adequacy is procured for 10 years from each resource type at an annualized per-kW net cost that is based on the base case findings from this study. The VPP provides incremental societal value of approximately $37/kW-yr. Values are presented as an undiscounted sum over a 10-year period in real 2022 dollars.

Sensitivity Analysis

The VPP is the only resource with the potential to provide resource adequacy at a negative net cost to society.

Net Cost of Providing 400 MW of Resource Adequacy
(Range observed across all sensitivity cases)



Note: See technical appendix for a complete description of modeling assumptions and data sources. Costs shown in 2022$.

Sensitivity cases modeled:

- Higher carbon price
- Lower carbon price
- Higher T&D cost
- Lower T&D cost
- 2030 technology cost trends
- Business-as-usual renewables deployment
- Alternative battery configuration
- Energy only (no ancillary services benefit)

The economic competitiveness of battery storage and VPPs **will vary from one market to the next,** and also will depend on the trajectory of future cost declines.

In markets with higher T&D costs or higher GHG emissions costs, **the additional (i.e., non-resource adequacy) value of a VPP can outweigh its costs,** thus providing resource adequacy at a negative net cost to society.

Additional Unquantified Benefits of VPPs

VPPs can provide several additional major benefits not modeled in this study.

INCREASED RENEWABLES DEPLOYMENT

By shifting load to hours when excess solar and wind generation otherwise would be curtailed, VPPs can increase the capacity factor of wind and solar generation. In turn, the cost-effectiveness and economic deployment of those resources could increase.

BETTER POWER SYSTEM INTEGRATION OF ELECTRIFICATION

VPPs can facilitate cost-effective deployment of electrification measures by reducing load impacts and associated infrastructure investment needs.

FASTER GRID CONNECTION

The highly distributed nature of VPPs means they are not limited by the same interconnection delays currently facing many large-scale resources.

FLEXIBLE SCALING

A gas peaker is a multi-decade commitment with risks of becoming a stranded asset. Alternatively, the capacity of VPPs can be increased or decreased flexibly over time to align with the needs of a rapidly changing power system.

ENHANCED CUSTOMER SATISFACTION

The opportunity to participate in a VPP unlocks a new feature of customer-owned DERs, improving the overall consumer value proposition of the technologies.

IMPROVED BEHIND-THE-METER GRID INTELLIGENCE

Improved visibility into a portfolio of energy technologies that are connected to the distribution grid can enhance the operator's ability to detect and respond to local changes in system conditions.

Moving Forward with VPPs

The Ideal Conditions for VPP Deployment

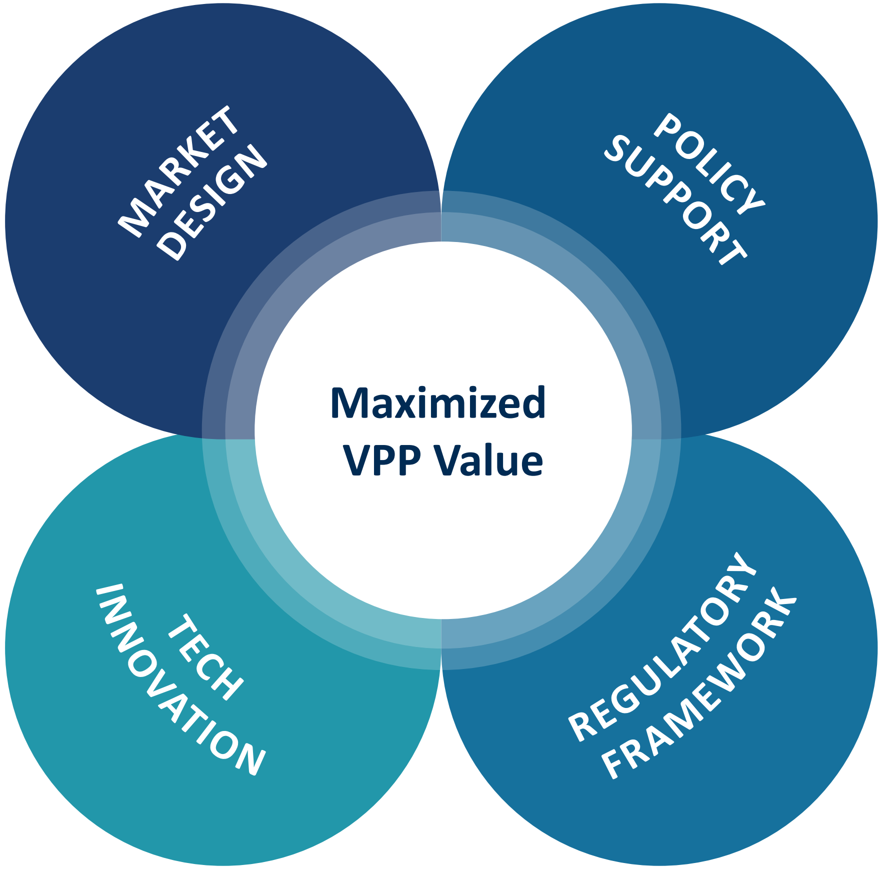
Innovation in technology, markets, policy, and regulation can enable VPP deployment.

MARKET DESIGN

- Wholesale markets provide a level playing field for demand-side resources
- Retail rates and programs incentivize participation in innovative, customer-centric ways

TECHNOLOGY INNOVATION

- DERs are widely available and affordable. DERs can communicate with each other and the system operator
- Algorithms effectively optimize DER use while maintaining customer comfort and convenience



POLICY SUPPORT

- Codes and standards promote deployment of flexible end-uses
- R&D funding supports removal of key technical barriers

REGULATORY FRAMEWORK

- Utility business model incentivizes deployment of VPPs wherever cost-effective
- Utility resource planning and evaluation accounts for the full value of VPPs

Overcoming Barriers to VPP Deployment

Barriers are preventing VPP potential from being realized. With work, they can be overcome.

	Key VPP Barriers	Possible Solutions	Examples
Technology	Lack of communications standards (between devices, with grid)	Initiatives to create coordination and standardization among product developers	The Connected Home over IP (CHIP) working group, Matter, the VP3 initiative
	Uncertain consumer DER adoption trajectory	R&D / implementation funding to improve products and reduce costs	Inflation Reduction Act tax credits for DERs and smart buildings
Markets	Prohibitive/complex wholesale market participation rules	Market products that explicitly recognize VPP characteristics	ERCOT's 80 MW Aggregated DER (ADER) Pilot Program
	Retail rates and program design that do not incentivize DER management	Subscription pricing coupled with load flexibility offerings; time-varying rates	Duke Energy pilot coupling subscription pricing with thermostat management
Regulation	Utility regulatory model that does not financially incentivize VPPs	Performance incentive mechanisms, shared savings models	At least 12 states with utility financial incentives for demand reduction
	Full value of VPPs not considered in policy/planning decisions	Regulatory targets for VPP development	Minnesota PUC 400 MW demand response expansion requirement

Note: For further discussion of barriers and solutions, see the U.S. DOE's A National Roadmap for Grid-Interactive Efficient Buildings.

Quick Wins

Among many options for enabling VPP deployment, here are three low-risk actions utilities and regulators can take in the near-term.

Conduct a jurisdiction-specific VPP market potential study. Then establish VPP procurement targets.

This is a common approach to promoting the deployment of renewables, energy efficiency, and storage.

Potential studies should account for achievable adoption rates and cost-effective deployment levels.

Establish a VPP pilot. Test innovative utility financial incentive mechanisms.

An inflection point in DER adoption is rapidly approaching; pilots will provide critical experience before it's too late.

Technology demonstration is not enough; regulatory models that allow utilities to share in the benefits also must be tested.

Review and update existing policies to comprehensively account for VPP value.

Methods for evaluating VPP cost-effectiveness often consider only a portion of the value they can create.

Evaluation of VPP proposals will need to account for benefits created by the full range of services VPPs provide, including energy savings, load shifting, peak clipping, real-time flexibility, and exports to the grid.

Conclusion

As decarbonization initiatives ramp up across the U.S., **affordability and reliability** are in the spotlight as the top priorities of policymakers, regulators, and utilities.

This study demonstrated that VPPs have the potential to provide the same reliability as conventional alternatives, with **significantly greater** affordability and decarbonization benefits.

While VPPs are beginning to be deployed across the U.S. and internationally, achieving the scale of impacts described in this study will require a **collective industry effort** to place VPPs on a level playing field with other resources.

A renewed focus on innovation in technology development, wholesale and retail market design, utility regulation, system planning, and customer engagement will be **key to ensuring that virtual power plants become more than just virtual reality.**

UNIQUE FEATURES OF THIS STUDY

Hourly reliability assessment, to ensure VPPs are evaluated on a level playing field with alternatives

Realistic representation of VPP performance characteristics and achievable levels of adoption

Analysis of net benefits, with comprehensive accounting for VPP costs

Focus on commercially-proven residential demand flexibility

Additional Reading

Brehm, Kevin, Avery McEvoy, Connor Usry, and Mark Dyson, "Virtual Power Plants, Real Benefits," RMI report, January 2023.

Hledik, Ryan, Ahmad Faruqui and Tony Lee, "The National Potential for Load Flexibility," Brattle report, June 2019.

Hledik, Ryan, Sanem Sergici, Michael Hagerty, and Julia Olszewski, "An Assessment of Electrification Impacts on the Pepco DC System," Brattle report prepared for Pepco, August 2021.

Kuiper, Gabrielle, "What is the State of Virtual Power Plants in Australia?" Institute for Energy Economics and Financial Analysis report, March 2022.

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Satchwell, Andrew and Ryan Hledik, "Making Grid-interactive Efficient Buildings a "Win" for Both Customers and Utilities," prepared for 2022 ACEEE Summer Study on Energy Efficiency in Buildings, August 2022.

Sergici, Sanem, Ryan Hledik, Michael Hagerty, Ahmad Faruqui, and Kate Peters, "The Customer Action Pathway to National Decarbonization," Brattle report for Oracle, September 2021.

Shah, Jigar, "VPPieces: Bite-sized Blogs about Virtual Power Plants," US DOE Loan Programs Office blog series.

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Zhou, Ella and Trieu Mai, Electrification Futures Study: Operational Analysis of U.S. Power Systems with Increased Electrification and Demand-Side Flexibility," NREL report, May 2021.

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Ryan focuses his consulting practice on regulatory, planning, and strategy matters related to emerging energy technologies and policies. His work on distributed resource flexibility has been cited in federal and state regulatory decisions, as well as by *Forbes, National Geographic, The New York Times, Vox*, and *The Washington Post.* Ryan received his M.S. in Management Science and Engineering from Stanford University, and his B.S. in Applied Science from the University of Pennsylvania.

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Kate focuses her research on resource planning in decarbonized electric markets and economic analysis of distributed energy resources. She has supported utilities, renewable developers, research organizations, technology companies, and other private sector clients in a variety of energy regulatory and strategy engagements. Kate received her B.S. in Environmental Economics from Middlebury College.

Clarity in the face of complexity

Brattle

Tennessee Solar Energy Industries Association

July 3rd, 2023

Hunter Reed
Project Manager

Kelly Baxter
NEPA Project Manager
400 W. Summit Hill Drive, WT 11B
Knoxville, Tennessee 37902

Subject: 2024 TVA Integrated Resource Plan (IRP) scoping comments

Dear Hunter Reed and Kelly Baxter,

TenneSEIA (Tennessee Solar Energy Industries Association) appreciates the opportunity to provide input on the scope of the 2024 TVA IRP. Meaningful engagement with stakeholders across the Tennessee Valley is a critical component of successful resource planning.

The purpose of the IRP is to determine how TVA can continue to provide low-cost, reliable electricity, support environmental stewardship, and spur economic development in the Valley; we believe there is no better way to accomplish this than for TVA to embrace solar, battery storage, and other renewable and advanced energy technologies.

Tennessee Valley Authority (TVA)'s 2024 Integrated Resource Plan (IRP) Scope should:

- Include strong Distributed Generation (DG) programs which enhance grid reliability and allow for more rapid deployment of renewable generation.
- Consider proactive transmission planning to unlock renewables in the highest-value areas of TVA's footprint and build IRP models that consider lowest cost transmission planning that does not create arbitrary caps on renewable expansion based on current transmission constraints.
- Consider areas of business process improvement and support a robust stakeholder process to resolve these current challenges, which is slowing renewable deployment, in the near term. TVA should not include any arbitrary caps on new renewables resources, either annual deployment or cumulative deployment.
- Treat BESS (Battery Energy Storage System) as a resource capacity and a reliability asset.
- Ensure it is best utilizing and optimizing the multiple new tax incentives provided under the Inflation Reduction Act, to decrease the cost of renewables and expand the deployment of solar and storage in the Valley.

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Include strong Distributed Generation (DG) programs which enhance grid reliability and allow for more rapid deployment of renewable generation.

TVA's past IRPs have not seriously considered the potential value in DG programs and resources spread out across the system. We believe this gap in consideration is a clear omission and that the 2024 IRP should include at least one Strategy model based on meeting a significant amount of its power needs through a maximum use of distributed carbon-free resources. There are multiple ways that TVA could enhance the use of distributed resources including a large comprehensive Virtual Power Plant (VPP) program, continued expansion of the Generation Flexibility program, and broadening the ability to self-generate to other customer classes.

On Thursday, June 22nd, 2023, TVA CEO Jeff Lyash, in a hearing in front of the U.S. House Transportation and Infrastructure Subcommittee on Water Resources and Environment, stated that TVA projects would need 50 to 100 percent more power by 2050. This planning assumption dramatically impacts TVA's need to embrace DG. Traditionally, TVA has made decisions on such issues as third-party Power Purchase Agreements (PPAs) for commercial and industrial customers with a focus on limiting the business model for DG due to the fear of reducing load and the associated revenue both for TVA and Local Power Companies (LPCs). In the current planning horizon, we are no longer looking at flat load growth projections but, instead, are challenged to meet future load requirements. TVA must plan to expand DG resources as these assets can be deployed much more quickly than large, centralized projects with their longer timelines due to the backlogged transmission interconnection queue, the time required for the National Environmental Policy Act (NEPA) process, as well as the extended construction timeline for network upgrades and interconnection facilities. DG also has the added benefit or value of improving grid reliability, which in the wake of Winter Storm Elliot is a critical priority.

While TVA has started work on a VPP program, based on the initial roll-out, tit appears to be nothing more than an enhanced demand response effort, lacking the distributed renewable energy and storage resources that define most VPP programs elsewhere in the country. If the VPP program were given the resources comparable to adding new traditional power plant(s), TVA could benefit dramatically. To highlight this opportunity, I have included in Attachment A of this letter the recent report from The Brattle Group "Real Reliability: The Value of Virtual Power: SUMMARY REPORT, MAY 2023."

In addition to TVA incorporating modeling of distributed resources, TVA has already started partnering with their LPCs in sharing the power generation with their Flexibility Generation program. Presently LPCs can generate up to 5 percent of their load themselves, with on-going discussions on increasing that percentage. The potential of this program is only now starting to be tapped. This is an exciting new strategy that was not addressed in the last IRP. LPCs have the ability to build out small solar systems that do not have to go through the NEPA process and do not typically require a transmission build-out. For a utility buildout by TVA from execution of engineering and procurement agreement to ready to energize, TVA is quoting three years for sites under 75 MVA and four years above 75 MVA; this timeline does not even consider the potential for network upgrades which may take additional years. If TVA is going to achieve its significant goals in the coming decades, TVA must consider the lower hanging fruit for renewable deployment.

In modeling potential scenarios to reach its carbon-free goals, TVA should separately determine 1) a percentage of generation that TVA's LPCs can provide and 2) the value of storage systems represented as a percentage of each incremental MW of solar generation (for example, that for every 1,000 MW of solar TVA should add a specific amount of storage to the grid).

As TVA considers expansion of the Generation Flexibility program, it must also ensure the tools that have allowed its initial success do not get lost in the expansion; specifically, the contract structure and offset at the TVA Wholesale rate. This offset structure allows a clear financial equation upon which LPCs can base decisions. It also enables renewable developers to standardize their financing structures thereby avoiding having to develop unique financing structures across 153 individual LPCs.

In considering the expansion of Generation Flexibility project, while maintaining the current commercial structure, TVA should not just view the value of the program as the PPA rate against the TVA wholesale rate, but should also consider 1) the increased speed of TVA solar deployment to support its long-term goals 2) the shift of the risk profile from TVA to the LPC and the developer and 3) the reduction of effort by the TVA Interconnection team in avoiding interconnection studies and in building large network upgrades.

It Is also critical to look at similar opportunities to expand self-generation to other customer types. In particular, third party PPAs have been in a state of legal uncertainty, due to a vague combination of LPC contracts and policy. Direct Serve customers who want to do renewables must go through Green Invest program, a successful program designed to help TVA's commercial customers meet renewable and climate goals. But Green Invest is not designed to encourage on-site self-generation and resiliency. Encouraging Direct Serve customers who have land or roof space on their facilities to be able to generate carbon free power has multiple benefits to both their customers, TVA, and the region: increased resiliency, opportunities for self-performing energy efficiency programs, and increased investment in the Valley. Investment in on-site renewables is an opportunity for a company to continue to put its roots down in TVA territory and TVA's willingness to consider this flexibility is an investment in Economic Development.

Consider proactive transmission planning to unlock renewables in the highest-value areas of TVA's footprint and build IRP models that consider lowest cost transmission planning that doesn't create arbitrary cap on renewable expansion based on current.

In other utility service areas, network upgrades take 3-5 years to construct and get online. In TVA, adding in the NEPA requirement adds an additional 18-24 months to the build out of these same network upgrades. Considering network upgrades on a project-by-project basis require immense individual effort and incurs significant, cost for just a singular project or few projects to proceed. If TVA were to plan large network upgrades proactively, study and approve them on a portfolio perspective, and include them in the base case planning for individual projects, a more efficient interconnection process would be created, and TVA would speed up its ability to add renewables to the grid.

Consider areas of business process improvement and support a robust stakeholder process to resolve these current challenges, which is slowing renewable deployment, in the near term. TVA should not include any arbitrary caps on new renewables resources, either annual deployment or cumulative deployment.

TVA has made immense strides in adding renewables to the grid; since 2016, TVA has added almost 1,000 MW. However, as TVA moves from adding MWs to adding GWs, it is facing challenges that many other large utilities in the country have struggled with, including long interconnection studies timelines, an inflated and backlogged interconnection queue, extended environmental review (i.e., NEPA) timelines, and long construction timelines for system upgrades. Additionally, TVA's contracting is laborious and slow because of its PPA (PPA) contract terms which are considered "out of market" relative to other regions. These PPA terms add unnecessary risk to the process and make it more difficult to develop renewables and deploy capital to build and operate these assets in the Valley. This is even more challenging for renewable investors as TVA is a monopoly market with no secondary offtake. In short, TVA is increasingly perceived as a higher risk and less-friendly place for businesses to invest and do business. While TenneSEIA is working with TVA to improve the business process, for TVA to meet its present targets, it is critical for TVA to accelerate the streamlining of and improvements in its business process on multiple fronts critical to mutual success.

Treat BESS (Battery Energy Storage System) as a resource capacity and a reliability asset.

TVA has undertaken the laudable planning effort to expand it Pumped Hydro Fleet, a well understood form of long duration storage, but has no significant program to deploy more BESS (Battery Energy Storage Systems) outside of packaging it with their regular RFPs. Even with the current RFPs, TVA's only views storage as a capacity resource and does not value the complete functionality of storage in managing the grid and in supporting reliability. It should be noted that a clear methodology to financially value large scale storage projects for the benefits that they bring to the system is necessary to be successful. As TVA renewable resources start to become a meaning part of its generation portfolio large scale storage will become crucial to help integrate more renewable energy, which tends to be intermittent. How to value BESS will be the critical element to encourage BESS (Battery Energy Storage Systems) adoption allowing renewables to become a critical component of the system.

TVA has been concerned about dependency on inverter-based resources, preferring traditional spinning reserve technology. This is not because modern inverter technology is not capable of providing the same benefits, but simply because TVA is not considering many of the features in modern power electronics to unlock this functionality. In many other markets, ancillary services are a competitive market and generators are compensated for their provision of service. However, many vertically integrated utilities do not have similar markets and do not pay generators for this feature. Storage deployment would accelerate significantly If TVA were to value these services and reflect this in their contracts.

Ensure it is best utilizing and optimizing the multiple new tax incentives provided under the Inflation Reduction Act, to decrease the cost of renewables and expand the deployment of solar and storage in the Valley.

The recently passed Inflation Reduction Act added new tax incentives to the existing renewable tax credits and specifically enabled TVA and Public Power to access these credits for which they were not eligible in the past. There are bonus credits for utility-scale and DG projects located in energy communities. Projects may also receive bonus credits for utilizing a specific percentage of domestic content. TVA should ensure that it optimizes these renewable credits to maximize the deployment of renewables in its footprint. TVA should take full advantage of these federal tax credits before tax provisions phase out in 2032. It should be noted that the recent Inflation Reduction Act (IRA) also has multiple credits to encourage best practices in solar and carbon free technologies, such as sitting on brownfields, paying prevailing wages, and using domestic content. Those incentives will reduce the environmental impacts of solar and storage projects and improve the economics of these renewable assets. TVA should consider how they can take a similar carrot approach to encouraging more solar and storage development in targeted sectors or areas.

The comments contained herein reflect the views of TenneSEIA and not the opinions of any individual member company. Thank you for your consideration of our input; if you have any questions, please do not hesitate to contact the Executive Director of TenneSEIA, Gil Hough, at execdirector@tenneseiasolar.com or (865) 789-5482.

Sincerely,

Gil Hough,

Executive Director, TenneSEIA

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From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#26]
Date:	Monday, July 3, 2023 1:48:11 PM

Name	Ann Livingston
Organization	Southeast Sustainability Directors Network
Email	
Phone Number	
Please provide your comments by uploading a file or by entering them below. *	Thank you for the opportunity to comment regarding the 2024 IRP Scoping process. Please find SSDN's comments on behalf of our Tennessee members attached. Thanks!
Upload File #1	ssdn_tva_irp_scope_letter.pdf 139.44 KB · PDF

SOUTHEAST SUSTAINABILITY DIRECTORS NETWORK

July 3, 2023

Kelly Baxter
NEPA Project Manager
400 W. Summit Hill Drive, WT 11B
Knoxville, TN 37902

Re: Comments from the Southeast Sustainability Directors Network on TVA's Integrated Resource Plan Scope

Dear TVA Board of Directors,

On behalf of the Southeast Sustainability Directors Network (SSDN) and its Tennessee members, I appreciate the opportunity to provide these comments and recommendations to the Tennessee Valley Authority (TVA) regarding the scoping of its upcoming Integrated Resource Plan (IRP) filing. SSDN and its members appreciate TVA's interest in seeking and incorporating ongoing stakeholder feedback and welcome additional collaboration and discussion on any issues described herein with TVA and relevant stakeholders. We urge TVA to consider increasing (1) demand side management offerings, including those for low-income residents, (2) flexibility for renewable energy allocation and pooling by the local power companies (LPCs) participating in the Valley Partners option, and (3) support for virtual power plants and other distributed energy resources (DERs), including through programs that appropriately compensate customers for power or excess power produced. We also request that TVA support an inclusive and collaborative IRP stakeholder process through the use of third-party facilitators and a framework for incorporating and recording stakeholder comments during this scoping period that is transparent and shared with stakeholders–similar to the facilitation processes used by many other large utilities to support major planning processes such as IRPs.

I. Introduction

SSDN is a network of local government sustainability professionals representing over 100 city, county, and tribal governments in 10 states across the Southeast, including the four[1] largest cities in Tennessee which represent approximately a third of the total population of Tennessee.[2] Through peer-to-peer learning and collaboration, SSDN and its members work together to

[1] SSDN's Tennessee members include Chattanooga, Knoxville, Memphis-Shelby County, and Nashville. For more information, see: https://www.southeastsdn.org/members/ssdn-members/

[2] (182,113 Chattanooga Population + 192,648 Knoxville Population + 916,371 Memphis-Shelby County Population + 692,587 Nashville Davidson County) / 6,975,000 TN population = 0.284

accelerate, scale, and implement programs to build more sustainable and resilient communities. As part of this work, SSDN regularly engages in direct conversations with utilities and key stakeholders to help ensure that clean energy programs are developed and implemented as effectively as possible for customers.

Local governments in Tennessee and throughout the Southeast are establishing long-term sustainability goals to reduce greenhouse gas (GHG) emissions, invest in clean energy and electric transportation, implement energy efficiency measures, create local jobs, and deliver immediate environmental, affordability, and public health benefits. SSDN members are regional leaders in local clean energy and climate action, with all of SSDN's Tennessee members tracking, measuring, and reporting GHG emissions for government operations.

Despite robust efforts at the community level, local governments are constrained in achieving their goals and reducing their total GHG emissions, given the inability to directly choose and optimize the sources of electricity that power their communities. As a result, cities and counties have a keen interest in improving the overall emissions performance of the electricity system. In addition, local governments understand firsthand how energy decisions affect their communities' overall affordability, economic competitiveness, and livability. High energy costs are a significant contributor to economic insecurity, and many low-income Tennesseeans also suffer disproportionately from the impacts of climate change and power plant pollution. Moreover, as some of the utilities' largest customers and good stewards of taxpayer dollars, local governments are acutely aware of the role that clean energy investments can play in keeping energy related operating costs reasonable and predictable over the long term while delivering significant economic benefits in terms of ratepayer costs as well as public and environmental health, resilience, and other non-energy benefits.

For these reasons, the scope of TVA's upcoming IRP filing is a significant priority for Tennessee's local governments. SSDN, on behalf of our Tennessee members, asks that the Commission consider the following recommendations in crafting the final TVA IRP scope.

II. SSDN member goals

TVA's Integrated Resource Plan is indispensable for fulfilling the utility service area's long-term energy needs through strategic resource decisions. These decisions have major ramifications for utility bills, the environment, customer well-being, local government action, and local and regional economies. SSDN members in Tennessee recognize the critical need to decarbonize energy sources, with all of SSDN's member governments in Tennessee having stated clean energy goals to be achieved in the next three decades. Chattanooga has a goal of achieving net zero-carbon emissions in City government operations by 2040 and city-wide by 2050.[3] Knoxville aims to reduce municipal emissions by 50 percent by 2030 and community emissions by 80 percent by 2050.[4] The Memphis Climate Action plan states an 80 percent carbon-free energy

[3] https://chattanooga.gov/city-planning/chattanooga-climate-action-plan
[4]https://www.knoxvilletn.gov/government/city_departments_offices/sustainability/climate_change#:~:text=Our%20new%20goal%20to%20reduce,while%20maintaining%20high%2Dquality%20services.

goal in electricity supply by 2035 and a 100 percent carbon-free goal by 2050.[5] Nashville's Metro Council has adopted a goal to reduce Metro's emissions by 80 percent relative to its 2014 levels by 2050.[6]

III. Continue to implement and expand demand side management (DSM) programs

A. **Increase demand side management offerings:** Energy efficiency and demand side management (DSM) programs are a least cost resource and should continue to be expanded to help local governments and other ratepayers address affordability and climate concerns. High energy costs are a major contributor to economic insecurity, and many low-income Tennesseans suffer disproportionately from the impacts of climate change and power plant pollution. DSM programs in Tennessee can significantly benefit low- and moderate-income (LMI) residents. Memphis experiences a significant energy burden among its low-income households, ranking among the highest in the nation. 50 percent of these households experience an energy burden exceeding 13.2 percent; 25.5 of these households face an even higher burden exceeding 25 percent. Similarly, in Nashville, half of the households encounter an energy burden of 6.4 percent, while a quarter of these households endure a burden exceeding 10.9 percent. These figures are considerably higher than the national average of 3.5%.[7] These high energy burdens are disproportionately shouldered by low-income households because of insufficient insulation, poor weatherization, older appliances, and an inability to access newer energy-efficient upgrades.[8] Accordingly, the development of residential energy efficiency programs could—and should—have significant equity impacts. The TVA IRP should enable increased access to energy efficiency programs for low-income residents through qualification criteria and collaboration with local governments around the state, including leveraging relationships with existing community-based organizations. We request that TVA consider opportunities to continue and expand DSM offerings overall as well as specifically for low-income households. Consideration of third-party modeling would allow for a robust analysis and the opportunity to maximize the implementation of DSM programs.

IV. Continue to implement and expand renewable energy and distributed energy resources (DER) offerings

A. **Virtual Power Plants (VPPs) and other DERs** are critical tools for addressing grid reliability, affordability, and sustainability. By coordinating the use of demand side

[5] https://shelbycountytn.gov/DocumentCenter/View/40521/2022_CAP_Annual_Report_FINAL
[6] https://www.nashville.gov/departments/mayor/news/mayor-cooper-launches-early-2022-sustainability-agenda
[7] How energy efficiency can help low-income households in Tennessee. American Council for an Energy-Efficient Economy. https://www.aceee.org/sites/default/files/pdf/fact-sheet/ses-tennessee-100917.pdf
[8] Drehobl, Ariel, Lauren Ross, and Roxana Ayala. 2020. How High Are Household Energy Burdens? Washington, D.C.: American Council for an Energy- Efficient Economy. https://www.aceee.org/research-report/u2006.

management tools, including thermostats and appliances; distributed energy resources (DERs), including batteries and solar arrays; and electric vehicles (where vehicle-to-grid technologies are available) across thousands of households and businesses, VPPs can contribute to grid reliability by offering resilience during outages as well as reduce the need for new generation assets. They can also rapidly deploy near loads to bypass transmission constraints and enhance affordability by directly compensating participants and reducing energy costs. Additionally, VPPs facilitate electrification by accommodating increased load and incentivizing the adoption of electric technologies. VPPs offer a promising solution to address the grid's challenges while promoting a more sustainable and equitable energy future. We ask that TVA consider the potential to expand VPP and other DERs offerings in the 2024 TVA IRP.

B. **Flexibility for renewable energy allocation and pooling** increases the options for the integration of renewable energy resources by local power companies (LPCs). Long-term LPC partners are currently allowed to self-generate up to 5 percent of their energy needs. There is significant interest in the program; 80 LPCs have signed Flexibility Agreements and 37 LPCs are actively engaged in planning 42 projects.[9] Over days and years, this flexibility is crucial for optimizing resource utilization in a cost-effective and environmentally sustainable manner.[10] Pooling also allows LPCs to build more renewable energy resources with less concern about exceeding their net cap of self-generated electricity stipulated by TVA. When close to this cap, flexible renewable energy allocation would allow one LPC to share excess capacity with other LPCs that may face challenges with siting generation within their service territory. We ask that TVA consider the potential to increase the cap for renewable energy allocation for all Valley Partners as well as opportunities to increase flexibility through pooling or similar strategies.

C. **The Dispersed Power Production Program** allows residents and businesses to produce renewable energy and sell all or excess generation to TVA at the avoided cost rate. Affordable and efficient distributed generation technologies enable electricity production from renewable sources, like solar, at residential and commercial locations. These systems effectively capture and utilize energy as well as significantly minimize or eliminate the energy loss that occurs during the transmission and distribution stages of the electricity delivery process.[11] We request that TVA evaluate opportunities to expand the Dispersed Power

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[9] Renewables Highlights, Fiscal Year 2022. Tennessee Valley Authority (2022). https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/energy/valley-renewable-energy/tva-renewables-highlights-report---fiscal-year-2022.pdf?sfvrsn=41675a30_1

[10] Olauson, J., Ayob, M., Bergkvist, M. et al. Net load variability in Nordic countries with a highly or fully renewable power system. Nat Energy 1, 16175 (2016). https://doi.org/10.1038/nenergy.2016.175

[11] Distributed Generation of Electricity and its Environmental Impacts. Environmental Protection Agency (2023). https://www.epa.gov/energy/distributed-generation-electricity-and-its-environmental-impacts

Production Program, or similar programs that effectively enable electricity production from renewable sources..

IV. IRP stakeholder process

SSDN appreciates the inclusion of our local government members in TVA's IRP stakeholder process to date, recognizing that local governments have a unique perspective to offer. However, we suggest that TVA partner with a third-party facilitator to conduct this process for a more robust discussion. A third-party facilitator would allow participants to operate with shared ground rules and serve as a neutral mediator between TVA and stakeholders during dialogue regarding the 2024 IRP.

SSDN also suggests TVA adopt a clear framework for incorporating stakeholder comments and feedback into the IRP. To ensure a transparent process and integration of input from stakeholders, SSDN urges TVA to include a record of where and how TVA integrates that feedback to ensure a multi-directional flow of information between TVA customers and stakeholders, TVA staff, and decision-makers. This is a best practice standard for local governments facilitating complex stakeholder engagement and planning processes as well a practice that is used by other large utilities during important planning efforts.

V. Conclusion

SSDN and our Tennessee members have a long history of partnering with TVA on energy programs that benefit Tennessee's residents, businesses, and local government operations. We look forward to and are committed to working with TVA to enable the solutions outlined in this letter to accelerate a more affordable, clean, equitable, resilient, and reliable energy system. Through continued partnership, we can demonstrate what collaborative clean energy leadership looks like to Tennesseeans and the nation. We appreciate the consideration of our recommendations and hope to continue active collaboration and partnership throughout the IRP process.

Respectfully,

Meg Jamison
Director
Southeast Sustainability Directors Network
423-416-0839 (mobile)
meg@southeastsdn.org

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#27]
Date:	Monday, July 3, 2023 1:48:22 PM

Name	Harry L Levinson
City	Pittsburgh
State	PA
Organization	Skibo Energy
Email	
Phone Number	
Please provide your comments by uploading a file or by entering them below. *	Attached is a proposal for system wide decarbonization of coal and natural gas power plants. The solution turns natural gas power plants into energy storage facilities (i.e. grid-scale battery equivalents) and enables GW of renewable PV/wind to be added to the power grid.
Upload File #1	skibo_energy_tva_decarbonization_proposal_july_2023.pdf 2.81 MB · PDF

Use

Storage First

to enable a transition strategy

decarbonize TVA's portfolio

Bottom Line Up Front (BLUF)

- TVA's decarbonization challenge is 20 GW or more of coal and gas plants
- **Storage First** decarbonizes natural gas power plants
  - Converts existing coal and gas plants to GWh grid-scale battery
  - Uses 'free energy' of gas turbine exhaust plus peak (excess) electricity
- 1 GWh system delivers annual revenues plus ancillary services
  - $26M of electricity arbitrage
  - Enables 1-3 GW of new renewable energy from PV/wind farms
  - Uses existing power generation technology
    - supplies both frequency and non-frequency related ancillary services

Miniature Suns across the world fueled by Nuclear Power

Fusion

Solar PV

Solar Heat

Wind

Hydro

Biofuels

Future Fusion Power

Fission

Geothermal

Existing / Future
Fission Plants

TVA's Decarbonization Challenge

- Need to close 5 coal plants generating 20 GWh of electricity annually
- Could replace with 100 GW of renewable energy of solar and wind at a 20% capacity factor but need storage and/or additional gas plants to handle peak loads
- Shifting 25% of the renewable energy 4 hours would require 25 GWh of battery storage at $500 / kWh would cost $12.5B
- Plus 12 GW or more of gas turbines for peaking

Storage First Value Proposition

- **Storage First** enables decarbonization through large, long duration, distributed storage capabilities
    - GW of PV/wind deployment
    - Transition to renewable natural gas (RNG)
    - Community scale solutions
- Sensitivity to power generation decarbonization risks
  - Project valuation **loosely tied to thermal efficiency**
  - Long-term valuation **loosely tied to electricity arbitrage**
  - Valuation **improves as deployment** moves up the supply curve (Wright's Law)
  - Enables decentralized power generation to **avoid grid expansion costs** and **improve grid reliability**
  - Technology is **available today** to deliver solutions in years not decades
  - Allows for **strategic deployment** of other power generation and storage solutions
    - Run baseload plants at maximum capacity (nuclear, hydro, etc)
    - Use li-ion for EVs and local reliability deployment
    - Use other utility scale storage batteries to address community grid management

Full-size Commercial Facility Economics - Comparison with Battery Storage

Component	Size	Intalled Unit Cost	Total Cost
Gas Turbine/Generator	50 MW-e	$2 M / MW-e	$100 M
ORC Power Block	30 MW-e	$1.5 M / MW-e	$45 M
PSHX High Pressure TES	400 MWh-t	$100,000 / MWh-t	$40 M
Open Low Pressure TES	800 MWh-t	$25,000 / MWh-t	$20 M
Closed Low Pressure TES	400 MWh-t	$50,000 / MWh-t	$20 M
Cold Storage	500 MWh-t	$80,000 / MWh-t	$40 M

Feature	Additional Electricity (MWh-e/day)	Electricity Cost ($/MWh-e)	Additional Annual Revenue
Cool Existing Turbine Inputs (60% capacity)	360	$100	$13 M
New Closed Turbine with Cooling (4 hr/day)	230	$100	$8 M
ORC Electricity (10 hr/day)	300	$100	$11 M
Peak Electricity	400	($20)	($3 M)
Lost SRC electricity (if NGCC)	300	($30)	($3 M)

Li-Ion

1100 MWh-e

$1100M CapEx

Assume 80% efficiency

$1M / MWh-e (CapEx assumption)

Annual Arbitrage - $29M

Payback – 38 Years

Lifetime – 15 Years

Ancillary Services – Extra costs

Storage First

900 MWh-e

$265M CapEx

TES ($120M) + Power ($145M)

Annual Arbitrage - $26M

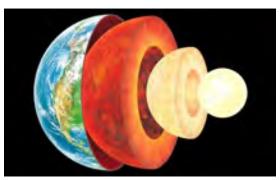
Payback – 10 Years

Lifetime – 30 Years

Ancillary Services - Included

Storage First Thermal Energy Storage (TES)

Solid Media Storage
Heat up to 1500C
Cold down to -200C



Concentric storage layers deliver multiple temperature stages

Pressurized heat drives gas turbines

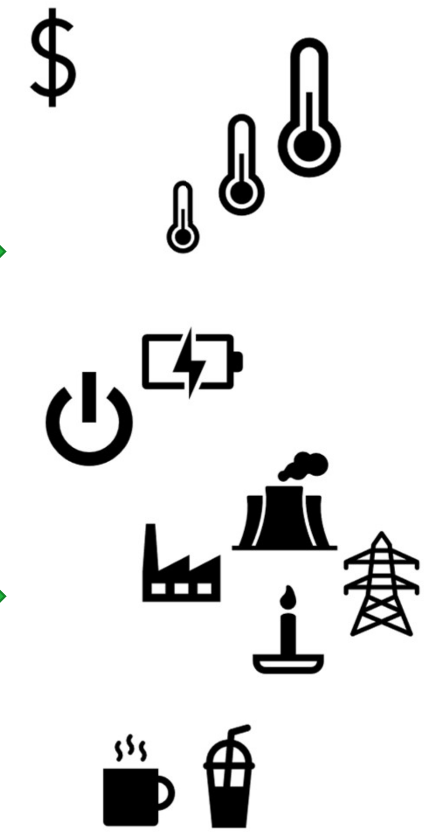
Efficiency

Ranges of Temperatures

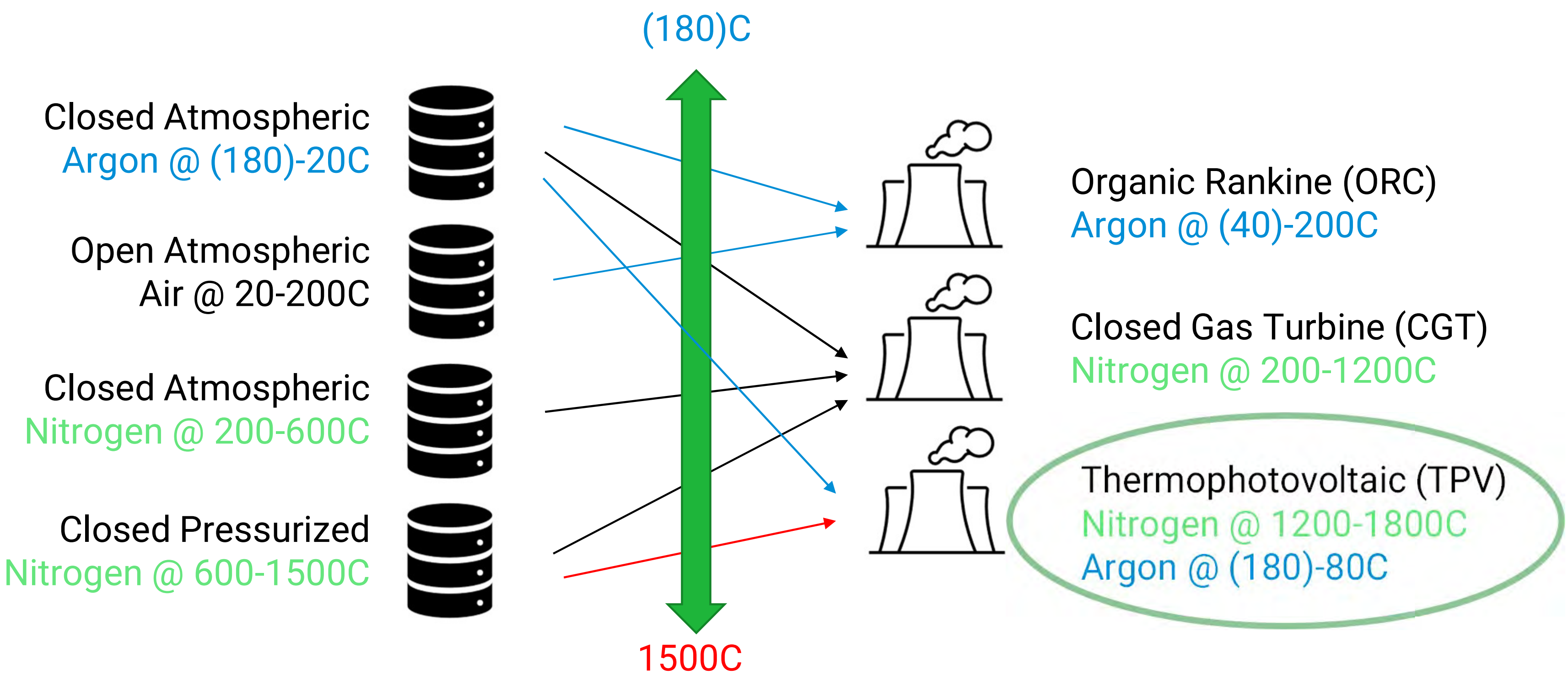
Power on Demand

Multiple Energy Sources

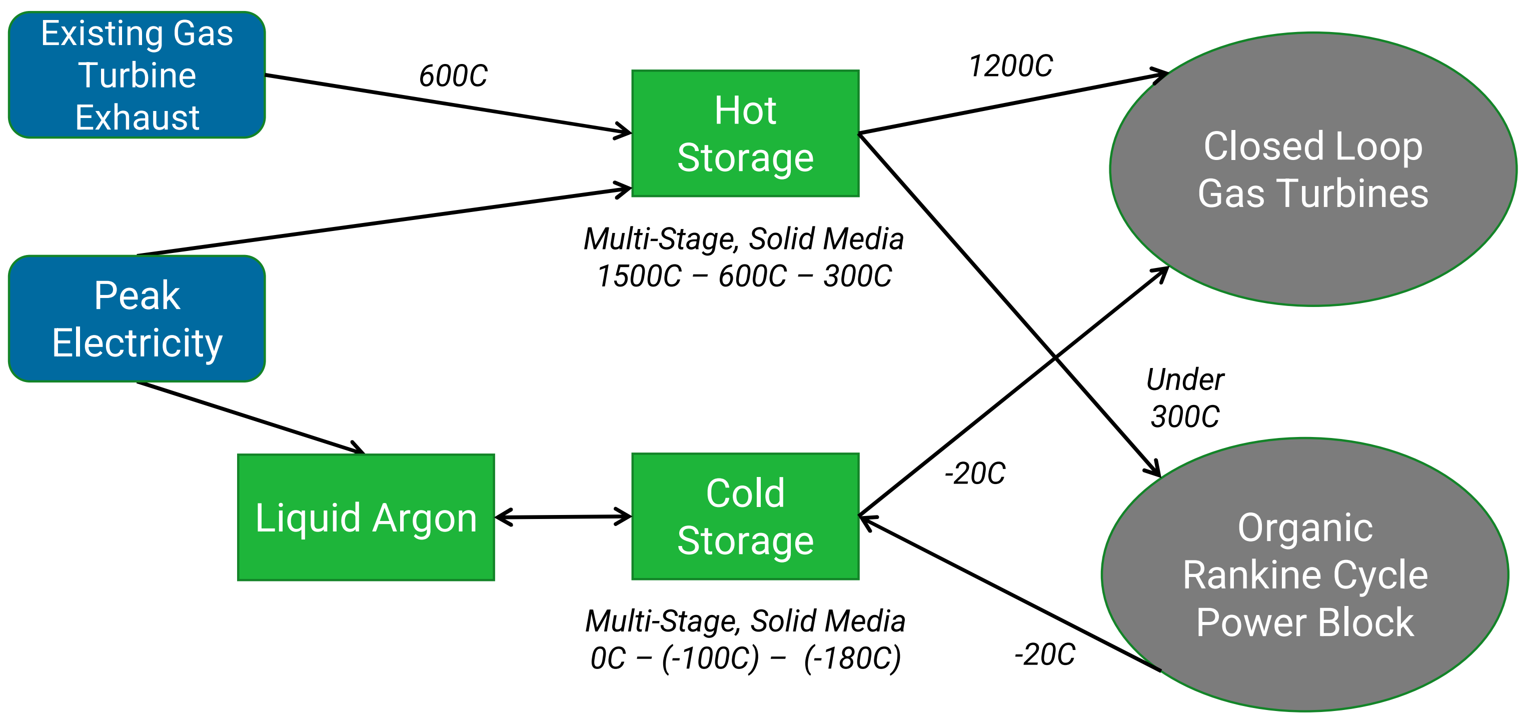
Heat and Cold



Storage First Components



H/CS GT Power Plant Transition



SKIBO ENERGY

Storage First Approach – Gallatin TN

Cool input to turbines reduces gas consumption by 30%

8 Single Cycle Gas Turbines
642 MW-e
@ ~40% Efficiency (H2E)
18% Capacity

Note: All numbers are rough estimates of annual operation

All this to reduce 50-70% annually
- **465,000 tons** of CO_2
- For TVA's 12 GW-e total
  - **8.7 Mt** of CO_2 removed annually
  - **$750M** of additional revenue

Burn 9M MMBtu-y of natural gas
$24-$48M @ $2.50-5 gas

1M MWh-e-y
$40-60M

1M MWh-e-y
$40-60M

Storage First
7,500 MWh-t
(200 cycles)

Build more PV/Wind to increase renewable heat and electricity

Operational cost breakdown
- Electricity ($8-16M)
- **Waste ($16-32M)**

1.5M MWh-t-y exhaust heat

Boost with 750,000 MW-e-y of Peak Electricity
$15M

150 MW Solar PV
150 MW Wind
50 MW Nuclear

Energy Transition for existing power plants

IRA storage tax credits support projects

Storage First

Thermal Energy Storage

Harry Levinson, President & CEO
Paul Klemencic, CTO & CFO
Pittsburgh, PA

412-225-6889

@skiboenergy

harry@skiboenergy.com

https://skiboenergy.com

More Details

Storage First
Revolutionizes Power Plant Design

Energy Storage

- Utility Scale Thermal
- Long-duration 10-100+ hours
- Configurable

leads to

System Designs

- Round-trip efficiencies >50%
- Long project lifetimes
- Transition existing power plants
- Incremental growth capability

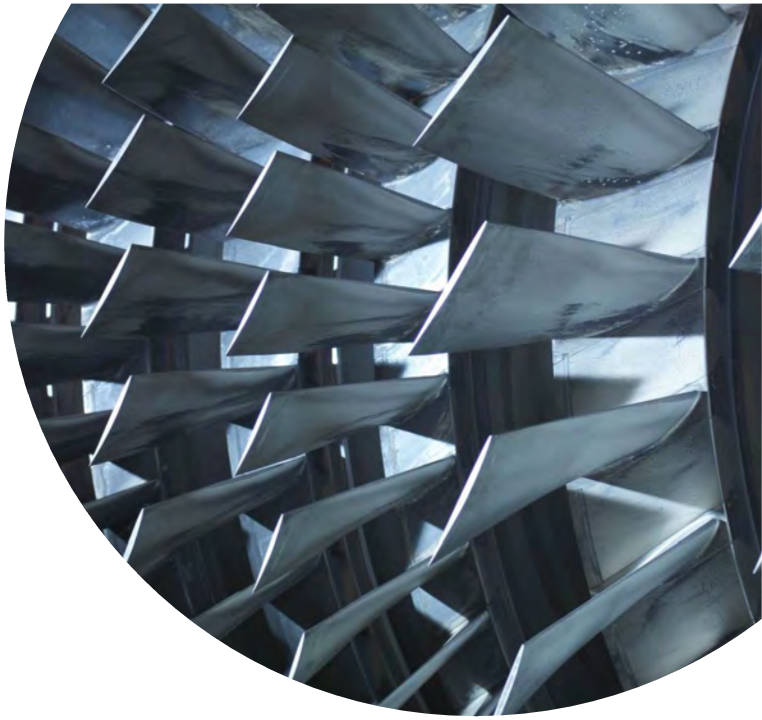
Storing Peak Electricity

	Electricity Storage	Industrial Heat	Limited Critical Materials	Geography Insensitive	Local Manufacturing	Economy of Scale
Mechanical (hydro, gravity, compressed air, etc)	XXX	X	XX	X	XX	XXX
Electrochemical (Li-ion, Sodium, Flow, Zinc, etc)	XXX	X	X	XXX	X	X
Chemical (Hydrogen, renewable gas, etc)	XXX	XX	X	XXX	X	XX
Thermal (Sensible, phase change, etc)	XXX	XXX	XXX	XXX	XXX	XXX

X – OK
XX – Better
XXX – Best

How **Storage First** Transforms Gas Plants

- Deliver **Power on Demand**
  - Store heat from **turbine exhaust** at gas plant
  - Use peak electricity
    - To **boost** low value heat to **1000C or more**
    - To **store cold**
  - Use power generation methods that uses the whole temperature range of **1500C to -200C**



Grid-scale storage

Electricity is generated only when needed

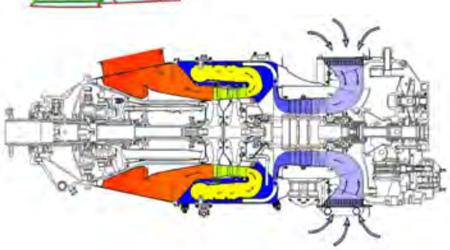
Grid reliability

Lowers cost of operation

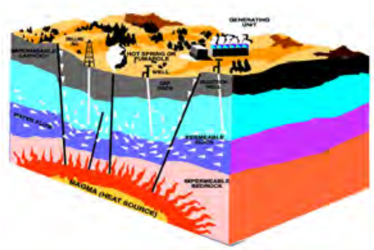
Enables more renewable energy on the grid

Minimum of Three **Trillion-Dollar** Markets

Transitioning **existing thermal power** plants to renewable energy sources to deliver variable electricity



Boosting Geothermal facilities with solar heat and peak electricity



Enabling large **Microgrids**

- PV
- Solar heat
- Batteries
- Peak electricity

Three of Many Roadmaps to Deploy TES, Cold Storage, and TPV Power Generators

	Phase 1	Phase 2	Phase 3	Phase 4
Cold First	ORC (-40C to 300C)	Gas Turbine (300C to 1000C)	TPV (1200C to1800C)	
Gas Transition	Store Exhaust (600C)	Closed Gas Turbine (600C to 1200C)	ORC (-40C to 300C)	TPV (1200C to 1800C)
Community Microgrid	MicroTurbine + Storage	Solar Heat (400C) + Closed Gas Turbine	ORC (-40C to 300C)	TPV (1200C to 1800C)

Staged GT Power Plant Storage Project - Deployment Plan

	Phase 1	Phase 2	Phase 3
TES	800 MWh $50M	1600 MWh $90M	3200 MWh $180M
CS	100 MWh $10M	200 MWh $20M	400 MWh $40M
GT	8 SGT-50 $40M	4 GT 10 MW(ea) $60M	2 GT 40 MW(ea) $70M
ORC	None	30 MW $50M	40 MW $60M
Incremental Investments	$100M / 16 MW / 900 MWh	$220M / 70 MW / 1800 MWh	$350M / 120 MW / 3600 MWh

6200 MWh-t TES + CS

206 MW-e Generation

enables → **1000+ MW** Wind/Solar

SKIBO ENERGY

Transition Natural Gas Power Plants

- Convert NG power plants to grid scale batteries using peak, intermittent electricity
  - Peak electricity occurs when **low** grid demand and **too much** electricity from Solar PV, solar heat, wind turbines, baseload fossil generation
  - Up to 80% of future power will be from storage
- Natural Gas has reached its peak but will be a transition fuel for decades
  - Electrification of home heating and cooking
  - RNG to be added to pipeline gas
  - **Green Hydrogen** won't be an economic solution for decades
- Target Conversion Market - All existing gas turbine generation to continue decades of operation
  - Singe Cycle
  - Cogeneration / Combined heat and power (CHP)
  - Combine Cycle (gas and steam)
  - Peakers

Founders

Paul Klemencic, Founder

- Energy Industry Veteran
- Deep Systems Expertise
- Longtime Technology Investor
- CMU Chemical Engineering

Harry Levinson, CEO

- Software / Hardware Design
- Small and Large Business Experience
- CMU Computer Engineering

Pittsburgh Engineering Team covers the field

- PhD, Systems Engineer
- Chemical Engineer
- BS, Mechanical Engineer
- Construction Engineer
- Experienced CSP, Systems, and Engineering design expertise

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#28]
Date:	Monday, July 3, 2023 1:51:32 PM

Name	Roger Babb
City	Ringgold
State	Georgia
Organization	Tennessee Valley Energy Consumers Group
Email	
Phone Number	
Please provide your comments by uploading a file or by entering them below. *	The Tennessee Valley Energy Consumers Group will be following the TVA 2024 IRP study, conducting our own model studies, and providing review and comments. TVECG is requesting, in fact insisting, that TVA halt further commitments to new natural gas plants until completion of the 2024 IRP and then decisions should be made in accordance with the IRP results. Please see our attached document. TVECG www.tvecg.com
Upload File #1	irp_comments.docx 16.98 KB · DOCX

TVECG Comments on TVA Executive Salaries and Bonus Objectives

The Tennessee Valley Energy Consumers Group represents the interests of energy consumers with the objective of a reliable supply of electric power at the lowest possible electric rates. See www.tvecg.com . We are concerned that TVA executive compensation is excessive and that the structure of the bonus calculations leads to decisions that may not be in the best interests of consumers.

From the time of its founding until 2004 TVA salaries were capped at what members of Congress are paid, currently $174,000 per year. During this time TVA service was extremely reliable and our electric rates were among the lowest. TVA has had many outstanding executives and their objectives were more about service to the region than about personal gain. This all changed in 2004 and today TVA executives make millions of dollars at consumer expense while service has declined and electric rates have escalated.

The excessive compensation may not be the worst part of the TVA executive pay system. A large part of the TVA executive pay is tied to meeting certain performance goals as detailed in the TVA 10-k reports. There is a major flaw with this system, the performance goals exclude the costs of fuel and purchased power which are directly passed through to consumers on monthly power bills. As a result, management objectives are not fully aligned with consumer interest and management has incentive to take actions that may not be in the consumer best interest. The management incentive is to take actions that limit non-fuel expenses with little regard as to increased fuel and purchased power costs which pass directly to the consumer. Consumers must pay the total cost for power while management is compensated based on minimizing only the non-fuel portion. This can lead to decisions that benefit management to the determent of consumers. Some examples:

- Natural gas plants have lower non-fuel expenses than most other types of generation, but higher and more volatile fuel prices. Management has the incentive to select the natural gas options and let the consumer bear the fuel cost risks.
- Solar has no fuel cost, but substantial non-fuel costs, so TVA owned solar goes against management incentives. When TVA does choose solar, they tend to buy it from power producers in which case it is purchased power and can be passed to consumers. Given that TVA has large land holdings plus huge buying power at low interest rates, it would likely by lower total costs for TVA to construct solar farms in addition to purchasing solar power.

The bottom line for TVECG is that we want management objectives aligned with the lowest total power cost as shown on consumer bills.

TVECG will be conducting our own power system planning studies using our own system model in parallel With the TVA IRP studies. The TVECG studies will differ from the TVA IRP in the following ways:

- The TVECG studies will be open collaborative studies with input, review, and comments from all our members. All data input, assumptions, and results will be open for our members' review and comment. This is a collaborative effort.
- The objective function of TVECG studies is reliable service at the lowest rate to consumers. Unlike the TVA management objectives, fuel cost and purchase power costs are included.
- The TVECG model is a full risk based model. Among those risks are the availability and cost of natural gas and the possibility of significant future requirements to reduce or capture emissions.
- The TVECG model is optimizing the cost of energy to consumers. It will include non grid connected home solar and direct appliance connected solar as well as home efficiency improvements. Optimizing consumer benefits may not always align with optimizing TVA management benefits.

TVECG requests that TVA delay the decision on the replacement of the any existing coal units with natural gas until after the completion of the TVA 2024 Integrated Resource Plan and then make the decision based on guidance from the 2024 IRP.

Roger Babb
Manager, TVECG
staff@tvecg.com
www.tvecg.com

From:	Kajumba, Ntale
To:	Integrated Resource Plan
Cc:	
Subject:	EPA Comments on the TVA IRP Scoping Letter
Date:	Monday, July 3, 2023 3:15:21 PM
Attachments:	TVA IRP Scoping Ltr.pdf

Good afternoon,

Hope all is well. Attached are EPA's scoping comments on the TVA Integrated Resource Plan NOI. Please let us know if you have any questions and we look forward to the EIS.

Ntale

Ntale Kajumba
NEPA Section Manager
Strategic Programs Office
U.S. EPA Region 4
61 Forsyth Street, S.W.
Atlanta, Georgia 30303

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
SAM NUNN ATLANTA FEDERAL CENTER
61 FORSYTH STREET, SW
ATLANTA, GEORGIA 30303-8960

July 3, 2023

Ms. Kelly Baxter
NEPA Specialist
400 West Summit Hill Drive
WT 11B
Knoxville, Tennessee 37902-1499

Re: EPA Comments on the Tennessee Valley Authority's Notice of Intent (NOI) to develop a Programmatic Environmental Impact Statement for the 2024 Integrated Resource Plan, Tennessee

Dear Ms. Baxter:

The U.S. Environmental Protection Agency (EPA) reviewed the referenced document in accordance with Section 309 of the Clean Air Act (CAA) and Section 102(2)(C) of the National Environmental Policy Act (NEPA). The CAA Section 309 role is unique to the EPA. Among other things, CAA Section 309 requires the EPA to review and comment publicly on any proposed federal action subject to NEPA's Environmental Impact Statement requirement.

The purpose of the proposed action is to develop a target power supply mix, known as the Integrated Resource Plan (IRP), to identify the most effective energy resource strategies that will meet the Tennessee Valley Authority's (TVA) mission and serve TVA's region. In the IRP, TVA intends to address energy resource strategies through 2050. Consistent with Section 113 of the Energy Policy Act of 1992, TVA employs a least-cost system planning process in developing the IRP. According to the NOI, TVA will consider multiple factors to develop the IRP, including: the demand for electricity, energy resource diversity, energy conservation and efficiency, renewable energy resources, flexibility, dispatchability, reliability, resiliency, costs, risks, environmental impacts, and the unique attributes of different energy resources.

As part of this new study, TVA plans to prepare a programmatic Environmental Impact Statement (EIS) to assess the impacts associated with the implementation of the next IRP. According to TVA, the EIS will address the effects of power production on the environment, including contributions to climate change and associated damages, the effects of climate change on the TVA region, and the waste and byproducts of TVA's power operations. The IRP will not identify specific locations for new resource options. Site-specific environmental effects of new resource options will be addressed in subsequent site-specific assessments.

Based on our review of the scoping document and review of recent NEPA documents for proposed improvements to TVA facilities, the EPA has the following comments:

Net Zero/GHG Emissions Reduction Policy and Goals: Given the urgency of the climate crisis, the EPA recommends that the new IRP scenarios consistently meet the science-based national mid-century and other net-zero emissions goals laid out by the Administration, TVA's own commitments, and the U.S. 2030 national reduction target in the Paris Agreement. Additionally, the IRP should reflect Executive Order 14057, which establishes a policy for the federal government to lead by example to achieve a carbon-pollution free electricity sector by 2035 and net-zero emissions economy-wide by no later than 2050.[1] The EPA recommends that TVA earnestly consider clean energy generation sources, such as solar and wind, and investments in energy storage and transmission and distribution grid improvements that will support the broader use of renewable energy sources. The EPA also recommends that TVA seriously consider comprehensive energy conservation, demand-side management, and energy efficiency measures that will reduce energy demand going forward. TVA should partner with other power generation and distribution experts such as the Department of Energy's National Renewable Energy Laboratory to draft an aggressive master plan that methodically reduces TVA's reliance on fossil fuels for power generation and mitigates its greenhouse gas emissions.

Regulatory, Policy and Energy Transition Trends: There have been significant statutory, regulatory, technological, and economic changes since the development of the 2019 IRP. For example, the Inflation Reduction Act (IRA) significantly reduces the costs of producing electricity with renewable energy and investing in demand-side management measures. The analysis should fully account for the expected cost decreases of renewable energy from the IRA and other changing market conditions. The Department of Energy has estimated the impacts of the IRA on clean energy and Greenhouse Gas (GHG) emissions.[2] The EPA recommends that TVA consider the proposed regulations and guidance released by the Internal Revenue Service on June 14, 2023, on the Direct Pay tax credits under the IRA in the EIS analysis.[3] TVA is an applicable entity, and the new direct pay provision will let TVA receive a payment equal to the full value of tax credits for building qualifying clean energy projects. TVA should consider updated resources such as the U.S. Treasury Department's Final Rule on Section 45Q Credit Regulations, that provide clarity on how to use the credit for qualified carbon sequestration. We strongly encourage TVA to consider and incorporate new and emerging technologies that are more economically advantageous as a result of IRA to include carbon sequestration, hydrogen, etc.

The EPA recommends that the 2024 IRP fully account for expected cost decreases of renewable energy and storage and higher future natural gas prices. The costs of renewable energy production and battery storage will continue to fall due to subsidies from the IRA and other market factors. Similarly, the price of natural gas is projected by the Energy Information Administration to be higher than TVA estimated in the 2019 IRP. Current and expected growth in the capacity of natural gas exports and other factors affecting natural gas markets and future prices should be carefully considered in the IRP.

The 2024 IRP needs to consider reasonably foreseeable costs, taxes, regulations, and subsidies to ensure TVA is fulfilling their statutory least-cost mandate. For the development of the 2024 IRP, the EPA recommends TVA reference the comment letters that the EPA previously provided to TVA on the Cumberland and Kingston Retirement projects for more detailed comments on concerns with the 2019

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[1] Executive Order on Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability https://www.whitehouse.gov/briefing-room/presidential-actions/2021/12/08/executive-order-on-catalyzing-clean-energy-industries-and-jobs-through-federal-sustainability/

[2]See, e.g., https://www.energy.gov/sites/default/files/2022-08/8.18%20InflationReductionAct_Factsheet_Final.pdf and https://www.energy.gov/policy/methodological-appendix.

[3]White House Guidance can be found at: https://www.whitehouse.gov/cleanenergy/directpay/ . See also the proposed regulations from the IRA: https://public-inspection.federalregister.gov/2023-12798.pdf https://www.irs.gov/pub/irs-drop/n-23-44.pdf

IRP. For instance, TVA has announced natural gas additions that are significantly higher than their central 2019 IRP recommendations at 5,900 MW, even though IRA subsidies are now available, renewables are projected to be cheaper, and the regulatory environment may make fossil fuel generation more expensive.

Emissions: Given that the IRP is a master planning effort, the EPA recommends that TVA compare and contrast the emissions of all potential new generation sources considered against existing infrastructure. TVA should use the best available Social Costs of Greenhouse Gases (SC-GHG) estimates in their NEPA analysis of the 2024 IRP. . The Council on Environmental Quality (CEQ's) interim guidance on consideration of GHG emissions and climate change in NEPA analyses notes that agencies "should apply the best available estimates of the SC-GHG" to the GHG emissions from a proposed action and its alternatives.

CEQ's interim guidance on GHG emissions and climate change notes that "[w]here helpful to provide context, such as for proposed actions with relatively large GHG emissions or reductions or that will expand or perpetuate reliance on GHG-emitting energy sources, agencies should explain how the proposed action and alternatives would help meet or detract from achieving relevant climate action goals and commitments, including Federal goals, international agreements, state or regional goals, Tribal goals, agency-specific goals, or others as appropriate." The EPA recommends the EIS include a discussion of whether and to what extent the estimated GHG emissions from the proposed alternatives are consistent with TVA taking action to help achieve science based national GHG reduction targets.

Future Regulations: Consistent with reasonably foreseeable regulations and the Administration's vision, the IRP should strategically consider alternatives that support the timely retirement of coal plants and allow for a transition to cleaner, more sustainable, and more cost-effective renewable power generation. In early 2023, the EPA proposed revised Steam Electric Effluent Limitation Guidelines (ELG), 88 Fed Reg 18824. The proposed 2023 ELG rule includes implementation flexibilities where appropriate. Recognizing that some coal-fired plants were in the process of closing, the 2023 proposed rule includes flexibilities that allow the plants to continue to meet the 2020 requirements instead of the new requirements contained in the 2023 proposed rulemaking. Similarly, the analysis should also evaluate the potential cost implications of reasonably foreseeable future air quality and greenhouse gas regulations on natural gas units, noting any uncertainties, as appropriate. For all options involving natural gas, plant designs should consider increased carbon capture and hydrogen fuel blending technology incorporation as a means of mitigating emissions and complying with future climate change regulations.

Environmental Justice: The EPA recommends that TVA analyze the potential for implementation of the IRP to reduce impacts on already overburdened and vulnerable communities through climate change[4], exposure to criteria air pollutants, and other harms related to electricity production and fossil fuel production and transportation. The EPA also recommends that TVA meaningfully engage and collaborate with underserved and overburdened communities to identify and address the adverse conditions they experience and ensure they do not face additional disproportionate burdens under the IRP. This would be consistent with Executive Order 14096, *Revitalizing Our Nation's Commitment to Environmental Justice for All,* which affirms the national policy to advance environmental justice for all and defines environmental justice as "the just treatment and meaningful involvement of all people, regardless of income, race, color, national origin, Tribal affiliation, or disability, in agency decision-making and other Federal activities that affect human health and the environmental so that people are

[4] See, e.g., Climate Change and Social Vulnerability in the United States, the EPA (2021).

fully protected from disproportionate and adverse human health and environmental effects (including risks) and hazards including those related to climate change, the cumulative impacts of environmental and other burdens, and the legacy of racism or other structural or systemic barriers." (Section 2(b)(i)). Notably, section 3a provides analytic direction that should be incorporated within the scope of the environmental analysis. In addition to the new executive order, the IRP should ensure consistency with the Executive Order 12898 of February 11, 1994, *Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations* by identifying and mitigating disproportionate impacts on communities with EJ concerns.

Climate Adaptation and Resilience: The EPA recommends that the IRP consider alternatives which are consistent with TVA's Adaptation Plan. TVA should evaluate how climate change impacts (such as increases in temperature, flooding, and drought events) may affect operations of all alternatives considered. The EPA recommends that this analysis use climate projections specific to the study area rather than using national or global climate projections. This analysis should also consider that increased heavy precipitation and flooding could potentially expand the existing 100-year floodplain, which may affect appropriate siting and elevation of infrastructure. Climate change may heighten the risk of landslides due to both higher wildfire risk and flooding, the compounding effects of which may result in destabilized soil and resulting debris flows. This heightened risk of landslides should also be considered in the climate impacts analysis. The EPA also recommends that in addition to the climate analysis on operations, TVA considers how alternatives may exacerbate climate change impacts to surrounding areas and consider opportunities to mitigate those impacts. For example, increased drought could reduce local water availability, heightening any impacts the alternatives have on water resources as well. For all the above, the EPA recommends that TVA consider adaptation measures to reduce impacts.

The EPA appreciates the opportunity to review the NOI and looks forward to continued participation with the update to the 2024 IRP. To discuss our technical recommendations further, please contact Douglas White of my staff at White.Douglas@epa.gov or (404) 562-8586.

Sincerely,

Ntale Kajumba
NEPA Section Manager

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#29]
Date:	Monday, July 3, 2023 3:22:44 PM

Name	Arash Ghodsian
City	Chicago
State	Illinois
Organization	Invenergy
Email	
Phone Number	
Please provide your comments by uploading a file or by entering them below. *	comments attached below
Upload File #1	20230703_invenergy_tva_irp_comments.pdf 108.57 KB · PDF

Invenergy

VIA ELECTRONIC DELIVERY
July 3, 2023

Kelly Baxter
NEPA Specialist
400 West Summit Hill Drive
WT 11B, Knoxville, TN 37902–1499.

Re: Notice of Intent - TVA Integrated Resource Plan and Environmental Impact Statement

Introduction
Invenergy thanks Tennessee Valley Authority (TVA) for the opportunity to comment on the 2024-2043 Integrated Resource Plan (IRP).

Invenergy is a global leader in the development and operation of sustainable energy solutions, having successfully developed over 30 GW of wind, solar and natural gas power generation and energy storage projects across the Americas, Europe and Asia. TVA and Invenergy have worked together for nearly two decades, successfully developing, Buffalo Mountain (the first wind project in Tennessee and Southeastern United States), White Oak, Bishop Hill I, California Ridge, and Yum Yum Solar, totaling over 750MW of renewable energy to the Tennessee Valley.

As TVA initiates its next IRP and begins strategizing to meet its long-term electricity needs reliably and cost-effectively, Invenergy would urge TVA to evaluate geographically diverse resources outside the Valley that can be delivered via high voltage direct current (HVDC) transmission projects like the Grain Belt Express transmission line (GBX). Consideration of geographically diverse supply side resources that can be accessed by a project like GBX will help TVA protect customers with zero fuel cost, high capacity factor renewables, increase the resilience and reliability of its electric resource mix, and advance interregional transmission that contributes to federal goals and national security.

GBX is an approximately 800-mile, 5,000-MW, 600kV HVDC transmission line that would enable TVA to access America's strongest wind energy resource in Southwest Kansas. GBX's state-of-the-art HVDC technology establishes a direct high-volume connection between three of the largest U.S. power markets, SPP, MISO and PJM as well as AECI, with the ability to efficiently deliver abundant, high-quality renewable energy from southwest Kansas to TVA.

Achieving Clean Energy Goals

TVA's last IRP highlighted a commitment to advancing renewable generation and outlined a goal of adding 10GW of new renewable resources by 2035. This remains a well-supported but ambitious goal towards sustainability in a short period of time. TVA has ~790 MW of solar in operation and is working on contracting more. While TVA has the opportunity locally to make progress toward its decarbonization goals through incremental solar resource additions, IRP modeling efforts that include complimentary resources, like GBX, will help TVA to advance towards its 10GW renewable generation goal at a larger scale to support both residential demand and commercial demand, particularly in tech and automotive industries.

Increasing Resource Diversity

Technological and geographic diversity have been shown time and time again to support system reliability. Evaluating resources outside the Tennessee Valley would provide TVA with access to technologically and geographically diverse renewable resources to take advantage of, for example, the complementary generation profile of high-quality remote wind and solar generation located hundreds of miles west in Kansas.

Access to remote complementary wind and solar generation profiles relative to that of local TVA generation would reduce the risks of coincident generation. The high coincident generation can lead to a simultaneous loss of output from local solar resources, representing a large single unit contingency.
Conversely, lower coincident and time-shifted Kansas solar generation delivered via GBX would naturally supplement local solar resources to reduce the risk of supply shortfalls. Furthermore, Kansas wind would provide valuable generation diversity to match TVA's peak load that occurs outside of peak solar generation hours. Kansas wind generation delivered via GBX is negatively correlated with local TVA solar generation and would provide even greater resource diversity, reliability, and resilience value to TVA.

Developing Resilience and Reliability

Severe weather events underscore the need for TVA to evaluate the benefits of geographically diverse generation resources located outside of the Valley to improve access to abundant, high quality renewable resources that could help to bolster reliability and ensure resource adequacy. The need for greater transfer capability among regions was noted in a report by ACORE documenting The Value of Transmission During Winter Storm Elliott, "As an influx of polar air caused record low wind chills, it also drove up wind energy output across the MISO, Southwest Power Pool (SPP), ERCOT, and PJM grid operating areas, driving power prices down. Unfortunately, there was insufficient transmission to deliver that wind energy to areas that needed it." A recent U.S.

Department of Energy (USDOE) analysis also noted the need for significant increases in transfer capability to relieve transmission capacity constraints between “the Midwest, Plains, and their adjacent neighbors...as increased access to low-cost generation in the middle of the country become more important to meet high demand.”

During Winter Storm Uri in 2021, TVA experienced demand increases and supply disruptions when local gas plants failed to quickly ramp-up, local coal plants were forced offline, and local solar could not adequately charge battery storage facilities. A direct link to geographically diverse wind and solar resources in Kansas delivered via GBX could have enabled TVA to access wind resources exceeding 60% capacity factor that would have bolstered resource adequacy during this system emergency. Moreover, pairing highly productive GBX-delivered wind with battery storage would have enabled full utilization of GBX's HVDC transmission capacity during TVA’s times of greatest need.

Similarly, demand spikes and supply disruptions during Winter Storm Elliot in December 2022 revealed the continued vulnerability in the bulk power system and the urgent need to invest in greater interregional transmission capacity to allow greater sharing of energy across regions during periods of grid challenges. During Winter Storm Elliott, TVA was forced to institute temporary rolling blackouts in its service territory for the first time in its 90-year history. The extreme winter grid conditions and unexpected generator outages not only dramatically decreased the availability of TVA owned and contracted electricity supply, but also the availability of electricity from neighboring markets. As a result, imports from neighboring markets facing their own resource adequacy challenges from Winter Storm Eliot were curtailed and TVA had to further roll back delivery to load.

Given the significant impacts severe weather events can have on TVA’s system, it is critical that the scope of TVA’s IRP should examine how tapping into interregional merchant transmission projects like GBX can help deliver the diverse energy supply needed to support system reliability and resiliency. Accessing generation projects hundreds of miles away, which are unlikely to be affected by severe weather events that impact generation assets within and adjacent to TVA’s territory, will improve resilience and reliability for the TVA system.

Advancing Interregional Transmission

Including evaluation of greater access to technologically and geographically diverse renewable energy through interregional HVDC facilities in TVA’s IRP would advance Federal Climate Goals and enhance national security. The Department of Energy’s (DOE) Building a Better Grid initiative, launched January 2022, supports nationwide development of long-distance, high-capacity transmission lines that are critical to the federal directive of 100% clean electricity by 2035 and a zero-emission economy by

2050. There are various pathways to meet federal climate goals, but all "require deploying interstate high-voltage lines connecting areas with significant energy resources to demand centers and linking together independently operated grid regions".

TVA is in a unique position to enhance national security through the inclusion of HVDC resources like GBX in 2024 IRP. HVDC transmission has unique technical capabilities that can connect TVA to AECI, PJM, SPP, and MISO. The enhanced controllability of HVDC would provide the operating flexibility required to meet the rapidly changing needs of the Department of Defense (DoD) and the communities that support them. Serving as the backbone of the grid, HVDC would perform as both the extension cord bringing electricity to customers impacted by disruptive events, and the jumper cables needed to restart grids suffering from outages.

It is widely recognized that interregional HVDC transmission provides significant reliability benefits by connecting supply and demand across multiple regions. Including resources like GBX will increase interregional reserve sharing and reliability strengthened with new a high-capacity link among SPP, MISO, PJM, and AECI. GBX would bolstering connectivity from TVA to other systems and provide:

- Bi-directional power flow between regions to aid in future severe weather events to prevent emergency outages
- Black start capability through Voltage Source Converter (VSC) technology that enables lines to use power from one market to jump start another outage-affected region, insulating TVA against future grid crises
- Voltage Sourced Converter stations that use digital controls that enable fast, precise control of active power flows and a wide range of ancillary service
- Services similar to large battery storage system
- More efficient power transfer over longer distances with lower line losses than AC systems

Including resources interconnected to HVDC transmission projects like GBX in TVA's IRP scope has significant potential to provide measurable reliability and resilience benefits to thousands of residential and industrial electric utility customers in TVA's service territory. The addition of the GBX transmission line and its interconnected firm power generation facilities would enable system operators to have access to a wider pool of resources beyond their geographic boundaries and therefore more cost effectively meet generation reliability requirements including Loss of Load Expectation (LOLE) thresholds.

Conclusion

Interregional HVDC transmission lines, such as GBX, are increasingly recognized as essential for ensuring electric system reliability as Americans use more renewable energy and face more extreme weather events. By creating a direct physical link between the SPP, MISO, PJM, and AECI systems with the ability to efficiently deliver high quality wind and solar generation from southwest Kansas to TVA, GBX would increase electric system reliability for the utilities and consumers in each region.

As TVA begins its IRP Scoping process, Invenergy strongly recommends TVA to evaluate geographically diverse resources outside the Valley that can be delivered via HVDC transmission projects like GBX. Consideration of these resources will help TVA meet its decarbonization goals, increase the resilience and regional reliability of its electric resource mix, and advance interregional transmission that contributes to federal goals and national security.

Respectfully submitted,

Invenergy LLC

Arash Ghodsian
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From:	Trey Bussey
To:	Integrated Resource Plan
Cc:	
Subject:	SELC et al. Scoping Comments on 2024 IRP
Date:	Monday, July 3, 2023 3:32:07 PM
Attachments:	2023-07-03_Conservation Groups" Scoping Comments on 2024 IRP.pdf

This is an EXTERNAL EMAIL from outside TVA. THINK BEFORE you CLICK links or OPEN attachments. If suspicious, please click the "Report Phishing" button located on the Outlook Toolbar at the top of your screen.

Dear Ms. Baxter,

The Southern Environmental Law Center, Center for Biological Diversity, Appalachian Voices, Sierra Club, Protect Our Aquifer, and Memphis Community Against Pollution respectfully submit the attached comments in response to TVA's notice of intent to prepare a new integrated resource plan and related environmental impact study. The comments fully incorporate the analysis of the Applied Economics Clinic report included within the attachment. Please let me know if you have any questions.

Sincerely,
Trey Bussey

Trey Bussey
Staff Attorney

Southern Environmental Law Center
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July 3, 2023

Via e-mail to IRP@tva.gov

Kelly Baxter
NEPA Specialist
400 West Summit Hill Drive
WT 11B
Knoxville, TN 37902-1499

RE: Scoping Notice for TVA 2024 Integrated Resource Plan and Environmental Impact Statement

Dear Ms. Baxter:

The Southern Environmental Law Center, Center for Biological Diversity, Appalachian Voices, Sierra Club, Protect Our Aquifer, and Memphis Community Against Pollution submit these comments in response to the Tennessee Valley Authority's notice of intent to prepare a new integrated resource plan (IRP) and related environmental impact study (EIS). These comments fully incorporate the analysis in the attached report by energy experts from the Applied Economics Clinic.[1]

The world has changed since the 2019 IRP. The climate crisis has deepened, with more frequent and intense heat waves, longer fire seasons and more severe wildfires, degraded air quality, more heavy downpours and flooding, increased drought, more intense storms, and harm to wildlife and ecosystems. In response, the United States has committed to limiting global warming to no more than 2ºC relative to pre-industrial temperatures,[2] and President Biden has established a national goal to achieve a "carbon pollution-free electricity sector by 2035."[3] In 2022, Congress enacted the Inflation Reduction Act of 2022,[4] which President Biden heralded as "the

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[1] Chirag T. Lala et al., Applied Economics Clinic, *Assessing TVA's IRP Planning Practices* (June 2023), **Attachment 1**.

[2] Paris Agreement to the United Nations Framework Convention on Climate Change art. 2 section 1(a), Dec. 12, 2015, T.I.A.S. No. 16-1104 (aiming to hold the increase in global average temperature to "well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change").

[3] Executive Order 14008, Tackling the Climate Crisis at Home and Abroad, 86 Fed. Reg. 7619, 7622 (Feb. 1, 2021); Executive Order 14082, Implementation of the Energy and Infrastructure Provisions of the Inflation Reduction Act of 2022, 87 Fed. Reg. 56861, 56862 (Sept. 16, 2022).

[4] Pub. L. 117-169, 136 Stat. 1818 (2022).

single largest and most ambitious investment in the ability of the United States to advance clean energy, cut consumer energy costs, confront the climate crisis, promote environmental justice, and strengthen energy security."[5] Among its other provisions, the IRA creates billions of dollars of incentives for deploying carbon-free technology. TVA is eligible for many of these incentives. To implement the IRA, Executive Order 14,082 directs federal agencies—including government-owned corporations—to "driv[e] progress to . . . achieve a carbon pollution-free electricity sector by 2035," and "promot[e] construction of clean energy generation, storage, and transmission[.]"[6]

Based on a review of TVA's three prior IRPs, Applied Economics Clinic recently concluded that TVA's 2011, 2015, and 2019 IRPs generally failed to:

- anticipate the size of coal retirements;
- limit the planned or actual growth of gas capacity; and
- plan adequately for a decarbonized gas system following 2019.[7]

Instead, TVA's IRPs, including the 2019 IRP, adopt broad planning ranges that deprive decisionmakers and the public of the ability to meaningfully assess the consistency of the utility's investments against its plans.[8] By deciding not to decide, TVA's 2019 IRP "may also result in ad hoc decision-making as TVA has no other benchmark for capacity additions beyond large ranges that can accommodate numerous conflicting possibilities, strategic investments (or lack thereof), and costs."[9] In other words, not only does the 2019 IRP fail to account for the dramatically changed world of 2023, but even on its own terms, it is so vague that it does not in any way justify TVA's proposals to build new gas plants to replace retiring coal or otherwise add new gas capacity.

The 2024 IRP is a critical opportunity for TVA to lead the national response to climate change while providing affordable and reliable power for ten million people throughout the region. To take advantage of this opportunity, Conservation Groups recommend the following:

<u>Decarbonization</u>

- **No new fossil fuels:** Since February 2021, TVA has rushed to add 5,900 MW of new gas-fired power plants, despite mounting evidence that a clean energy portfolio is more cost effective. Synapse Energy Economics has calculated that replacing TVA's coal plants with a clean energy

[5] Exec. Order 14,082, Implementation of the Energy and Infrastructure Provisions of the Inflation Reduction Act of 2022, 87 Fed. Reg. 56,861 (Sept. 12, 2022).
[6] *Id.* at 56,862.
[7] AEC IRP Report, 16.
[8] *Id.*
[9] *Id.*

portfolio would save ratepayers $9.4 billion over twenty years.[10] By replacing all of TVA's fossil fuel plants with a clean energy portfolio by 2035, TVA would save families $255 billion by 2050.[11] TVA has attempted to justify the massive gas buildout by pointing to an outdated IRP, which did not include Inflation Reduction Act pricing, President Biden's decarbonization targets, or even TVA's less ambitious decarbonization targets. Despite these targets and a pending EPA rule,[12] TVA has not accounted for the costs of mitigating the greenhouse gas emissions from its coal and gas plants. Nor has TVA accounted for increasing fuel cost volatility for its gas plants, despite the fact that end-use customers throughout the Valley foot the bill. Without an up-to-date IRP, TVA has no basis to conclude that its massive investment in new gas plants contributes to a portfolio that achieves the lowest system cost. TVA should not make final decisions to invest in additional gas plants, including those currently proposed to replace the Kingston Fossil Plant and Cumberland Unit 2 (Cheatham County Gas Plant), until after TVA has completed updated long-term resource planning. Further, because TVA has relied on flawed and outdated analysis, proposed and under-construction gas plants should not be considered existing resources but instead should be considered potential capacity additions that must compete with other resources, including wind, solar, energy efficiency, battery storage of various durations, and demand response.

- **Decarbonization targets**: TVA must clearly incorporate net-zero climate targets as a policy goal and basic modeling limitation in its IRP. All TVA portfolios should achieve the federal climate goals of achieving a carbon-pollution free electricity sector by 2035.[13] TVA's 2019 IRP is rendered defunct by TVA's own emission targets, as well as by Executive Orders calling for a carbon-pollution free electricity sector by 2035. TVA should be transparent both about its scheduled

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[10] Rachel Wilson et al., Synapse Energy Economics, *Clean Portfolio Replacement at Tennessee Valley Authority* (May 2022) (on file with agency).

[11] Pat Knight et al., Synapse Energy Economics, *TVA's Clean Energy Future* (March 2023) (on file with agency).

[12] EPA, New Source Performance Standards for Greenhouse Gas Emissions from New, Modified, and Reconstructed Fossil Fuel-Fired Electric Generating Units; Emission Guidelines for Greenhouse Gas Emissions from Existing Fossil Fuel-Fired Electric Generating Units; and Repeal of the Affordable Clean Energy Rule, 88 Fed. Reg. 33240 (May 23, 2023), https://www.federalregister.gov/documents/2023/05/23/2023-10141/new-source-performance-standards-for-greenhouse-gas-emissions-from-new-modified-and-reconstructed.

[13] *See* Executive Order 14008, Tackling the Climate Crisis at Home and Abroad, 86 Fed. Reg. 7619, 7622 (Feb. 1, 2021); Executive Order 14082, Implementation of the Energy and Infrastructure Provisions of the Inflation Reduction Act of 2022, 87 Fed. Reg. 56861, 56862 (Sept. 16, 2022).

capacity additions and retirements, and about which resources will supply the necessary emission reductions to meet these climate goals.

Transparency

- **Modeling transparency**: TVA must be more transparent regarding its assumptions and modeling inputs, including its assumed carbon price and social costs of further investments in GHG-emitting resources. Accordingly, TVA should make its detailed technical appendix available for public review.

- **Targeted portfolio**: The TVA Act requires TVA to implement a "planning *and selection* process for new energy resources."[14] The 2019 IRP largely decided not to decide, including extremely broad ranges of potential resource additions. TVA's next IRP needs a clear selection of a portfolio with a more targeted preferred resource plan. The selected portfolio should provide schedules for prospective additions of resources. Absent these detailed expectations, planning ranges alone do not permit either TVA or other stakeholders to assess the environmental and economic impacts of the most likely resource additions or effectively evaluate the benefits of prior capacity additions.

- **All-resource request for proposals**: TVA should conduct an all-resource RFP of resources that could be made available today under current market prices. Resource cost assumptions uninformed by an all-resource RFP provide inferior information that biases modeling results.

- **Asset selection**: TVA's asset decisions have not always aligned with its own IRPs. For example, TVA is now relying on the 2019 IRP in considering how to replace the Kingston coal plant, but the 2019 IRP did not evaluate retiring Kingston. TVA must ensure that its site-specific planning documents—such as environmental impact statements for particular resource decisions—reflect the most recent IRPs' plans and methods that do not result in contradictions between overall-system and site-specific planning exercises. Site-specific planning exercises should also provide technical appendices with information on modeling inputs and outputs, including explaining departures from assumptions that informed the applicable IRP.

- **Stakeholder intervention and robust engagement**: Stakeholders should be able to intervene in the IRP process. That process should allow intervenors to submit discovery requests for information

[14] 16 U.S.C. § 831m-1(b)(1).

pertinent to the IRP. TVA should promptly respond to those requests. All intervenors should be authorized to submit comments and expert testimony to the TVA Board. An independent entity or the TVA Board should preside over an IRP hearing in which TVA and intervenors present their case under oath, subject to cross examination.[15]

- **Accessibility**: TVA should hold multiple public comment forums for the IRP throughout the TVA region, with at least one in each state and multiple in Tennessee. TVA should ensure that IRP hearings, forums, and working group meetings are open to the public and streamed live.

- **Equity and environmental justice:** TVA must ensure compliance with Executive Order 14091, including by proactively engaging with underserved communities, creating economic opportunity in rural America and advancing urban equitable development.[16]

- **Independent administration and advice**: An independent entity should provide oversight on public comments provided to the TVA Board outside the NEPA process. That entity should advise the TVA Board on whether and how those comments inform the final IRP. TVA should provide the TVA Board with independent expert staff, selected with input from the Board itself and a range of stakeholders, to support their engagement in the IRP process.

Clean Energy Resources

- **Inflation Reduction Act**: TVA should state clearly how it intends to maximize the benefits and programs of the Inflation Reduction Act. One example is the direct payment of IRA tax credits, allowing TVA and local power companies to finance eligible projects through direct payments from the U.S. Treasury.[17] TVA should model multiple IRA implementation strategies, including strategies in which TVA itself leverages direct pay and other provisions of the IRA, strategies in which TVA removes the harsh 5% cap on local renewables for Valley Long Term Partners and allows these local power companies to access affordable clean energy directly for the benefit of their ratepayers, and

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[15] The Board is authorized to "conduct such public hearings as it deems appropriate on issues that could have a substantial effect on (i) the electric ratepayers in the service area; or (b) the economic, environmental, social, or physical well-being of the people of the service area." 16 U.S.C. § 831a(K).
[16] Executive Order 14091, Further Advancing Racial Equity and Support for Underserved Communities Through the Federal Government, 88 Fed, Reg, 10825 (Feb. 2, 2023).
[17] *See* Internal Revenue Service, Section 6417 Elective Payment of Applicable Credits, 88 Fed. Reg. 40528 (June 21, 2023).

strategies that combine these approaches. TVA needs to document how IRA programs affect its modeling, selected resource plans, and finances.

- **Solar ownership:** TVA must clarify how it demarcates "ownership" of solar and wind resources between its distribution utilities, power purchase agreements from other parties, and capacity that TVA outright owns. Currently, TVA does not specify why its claimed solar and wind resources are not reported in EIA data, nor the extent to which its renewable resources are capacity owned and operated by its distribution utility partners or capacity it has access to through power purchase agreements. TVA should also be transparent about ownership of renewable attributes, such as any renewable energy credits sold through TVA's Green Invest program.

- **Renewables data:** TVA should provide reliable annual or monthly data on its existing solar, wind, and storage capacity. These time-series data should also distinguish between utility-scale resources that represent TVA's own capacity, contracted capacity, and/or capacity from TVA's distribution utility or municipal partners that TVA claims as its own. These data are essential to an effective evaluation of TVA's past and future plans by making a comparison between proposed and actual renewable additions.

- **Fulfill the 2019 IRP's clean energy commitments**: In the 2019 IRP, TVA made several important commitments to expanding clean energy. Those include a "market potential study for energy efficiency and demand response," as well as "development of Distribution Resource Planning for integration into TVA's planning process."[18] TVA has not published either, and we are unaware of any significant progress made on these two important processes to date. TVA must follow through on these commitments to inform the 2024 IRP and as it works to expand energy efficiency, demand response, and distributed energy resources throughout the Valley.

- **Resiliency**: TVA must reassess the reliability and resilience of clean energy resources relative to fossil fuel resources. TVA has continually characterized gas-fired generation as resilient and clean energy resources as unreliable. TVA's rolling blackouts during Winter Storm Elliott told another story. Two coal plants and one-third of TVA's gas units failed.[19] Solar and storage performed as expected, including

[18] 2019 IRP at ES-5.
[19] *See generally* TVA, After Action Report: Winter Storm Elliott (May 2023).

during the blackout periods.[20] Not only did clean energy resources play an important role during Winter Storm Elliott, but they have contributed to grid resiliency during extreme weather throughout the country. During an extreme heat wave in California last summer, demand response and battery storage were broadly credited with keeping the lights on despite record demand.[21] During another heat wave this summer, solar helped Texas meet record demand.[22] Not only did gas infrastructure disproportionately fail during Winter Storms Elliot and Uri, but NERC found that "[i]n 2022, conventional generation experienced its highest level of unavailability (8.5%) overall since NERC began gathering [Generating Availability Data System] data in 2013 as measured by the weighted equivalent forced outage rate . . . ."[23]

- **Solar integration**: TVA should consider the role storage can play in its current plans to reach 10,000 MW of solar by 2035. TVA has repeatedly justified building new gas plants by citing the need to integrate 10,000 MW of solar.[24] TVA must analyze whether storage, including long-duration battery storage, can integrate solar better than new gas plants can. Not only does storage exceed gas plants' flexibility, but storage can use excess solar to charge, avoiding the need to curtail excess renewables. Additionally, TVA should consider policy changes that reduce land-use impacts and increase community resilience, such as opening up its policies on distribution-level projects, including local power company flexibility and net-metered rooftop solar.

- **Local environmental impacts**: TVA must account for the local environmental impacts of various energy resources. For example, TVA's generation fleet has significant impacts on water resources. Each type of generation has different impacts on groundwater and surface water, such as from use of cooling water or discharge of

[20] Robert Zullo, Tennessee Lookout, How Did Renewables Fare During Winter Storm Elliott (Jan. 31, 2023), https://tennesseelookout.com/2023/01/31/how-did-renewables-fare-during-winter-storm-elliott/.
[21] Anna Blaustein, Scientific American, How California Kept the Lights on During Monster Heat Wave (Sept. 16, 2022), https://www.scientificamerican.com/article/how-california-kept-the-lights-on-during-monster-heat-wave/.
[22] J. David Goodman, N.Y. Times, Facing Brutal Heat, the Texas Electric Grid Has a New Ally: Solar Power (June 23, 2023), https://www.nytimes.com/2023/06/23/us/texas-heat-solar-energy.html.
[23] North American Electric Reliability Corporation, *2023 State of Reliability Overview* (June 2023).
[24] Cumberland Fossil Plant Retirement, Final EIS ii; Johnsonville Aeroderivative Combustion Turbines Project, Final Environmental Assessment 1 (July 2022).

wastewater. TVA should mitigate local impacts on water resources by using recycled greywater and by prioritizing lower-impact capacity additions, such as demand response and energy efficiency.

Transmission

- **Transmission planning**: TVA must integrate transmission planning into its 2024 IRP process. TVA has consistently rejected clean energy alternatives for fossil fuel plant replacement in part because of the lead times required for transmission upgrades that TVA claims are necessary to accommodate renewable energy. This purported challenge, to the extent it has some basis in fact, could be avoided through transparent, proactive transmission planning that is coordinated with the IRP process. Such a process will also allow stakeholders to evaluate which transmission upgrades should be attributed to renewable energy and which are necessary due to deferred maintenance of transmission assets, localized load growth or other reasons. Further, TVA must study the potential for enhanced broader regional transmission. To date, TVA has not properly valued the benefits of transmission investments, particularly with respect to resiliency and renewables integration. While TVA was implementing rolling blackouts during Winter Storm Elliott, neighboring utility Southwestern Power Pool curtailed approximately 3,000 megawatts of wind, partly due to insufficient interregional transfer capacity.[25] The Department of Energy has found that substantial interregional transfer capability is required between the Southeast (i.e., TVA) and the Gulf region.[26]

Load Growth and Electricity Demand

- **Electrification of transportation and buildings**: TVA should model various electrification scenarios with different load growth projections. TVA should also evaluate whether the utility and its local power company customers can implement policies that promote the electrification of transportation and buildings while minimizing additional capacity requirements. For example, TVA should consider appropriate time-of-use rate structures that incentivize off-peak charging for electric vehicles. TVA should also consider the potential for vehicle-to-grid technology to provide demand-response services and other grid benefits. TVA should also evaluate how distribution resource planning and distributed energy resources, including

[25] *Wasted Wind and Tenable Transmission During Winter Storm Elliot*, RMI (Feb. 16, 2023).
[26] Department of Energy National Transmission Needs Study (Feb. 2023).

distributed solar, energy efficiency, and demand response, can support beneficial electrification.

- **Crypto-mining and other large, non-essential energy users**: While TVA does not disclose information about the location or energy demand of crypto-mining facilities or other non-essential energy users, publicly available information indicates that the total annual demand of crypto-mining facilities in the TVA region is at least 665 MW,[27] equivalent to a gas-fired power plant. TVA should use the IRP process to determine the scale and impacts of, and potential responses to, the increase in energy demand from crypto-mining facilities and other large non-essential energy users. TVA should examine demand response solutions for mitigating the harmful impacts of crypto-mining facilities and other large non-essential energy users.

Thank you for your consideration of our comments. Please contact us if we can answer any questions.

Sincerely,

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[27] See FracTracker Alliance, Cryptocurrency mining operations in the United States (Dec. 2022). Available at: https://ft.maps.arcgis.com/apps/webappviewer/index.html?appid=30c9ac5f2cd24732b0c8246cc1314107.

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Attachment 1

Assessing TVA's IRP Planning Practices

Prepared on behalf of the Southern Environmental Law Center (SELC)

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Applied Economics Clinic

Economic and Policy Analysis of Energy, Environment and Equity

Executive Summary

As the United States' largest public power producer, Tennessee Valley Authority (TVA) must plan and invest to meet aggressive decarbonization targets. TVA conducts regular Integrated Resource Plans (IRPs) to: 1) assess what its resource needs are; 2) evaluate what resources could meet those needs; 3) model different resource combinations under varying conditions; and 4) publish "planning ranges" estimating how much capacity it may add or retire for each resource. In principle, the IRPs should present reasonable ranges (and a schedule) against which TVA's actual capacity additions and retirements can be compared. TVA's 2011, 2015, and latest 2019 IRPs, however, neither clearly explained its planning processes nor gave an accurate picture of future resource decisions.

A useful IRP process has three key features: 1) It bases its modeling and analysis of potential resources on a survey or "all-resource RFP" of available energy resources and their characteristics; 2) the IRP designates a preferred portfolio—a combination of resource additions and retirements that together will meet future demand for power; and 3) the IRP's results and planning methods are adequate (an accurate enough) to inform subsequent site-specific instances of planning. This Applied Economic Clinic (AEC) report assesses TVA's 2011, 2015, and 2019 IRP results by comparing them with TVA's actual additions and retirements from 2011 to 2021 and finds TVA's process and results lacking. This report also compares TVA's 2019 IRP to site-specific planning for the replacement of TVA's Cumberland Fossil Plant. The report presents the following takeaways:

- **TVA must set aggressive climate goals** in line with the Paris Agreement's requirement to limit temperature increases and with the Biden Administration's executive orders requiring a carbon-free electric system by 2035.
- **TVA must be more transparent** regarding its assumptions and modeling inputs.
- **TVA must select a portfolio with a more targeted preferred resource plan** than its prior IRPs**.**
- **TVA should plan to utilize the grants, loans, and tax credits of the Inflation Reduction Act** to achieve aggressive climate targets.
- **TVA must clarify how it demarcates "ownership" of solar and wind resources** between its distribution utilities, power purchase agreements from other parties, and capacity that TVA outright owns, and provide reliable annual or monthly data on solar, wind, and storage capacity.
- **TVA should conduct an all-resource RFP for resources,** at market prices, that could be made available by the time new capacity is required, and compare and include price forecasts from reputable sources.
- **TVA must ensure that its site-specific planning documents reflect the most recent IRPs' plans and use methods that do not contradict overall-system- and site-specific planning exercises.**

Table of Contents

About the Applied Economics Clinic

Based in Arlington, Massachusetts, the Applied Economics Clinic (AEC, www.aeclinic.org) is a mission-based non-profit consulting group that offers expert services in the areas of energy, environment, consumer protection, and equity from seasoned professionals while providing on-the-job training to the next generation of technical experts.

AEC's non-profit status allows us to provide lower-cost services than most consultancies, and when we receive foundation grants, AEC also offers services on a pro bono basis. AEC's clients are primarily public interest organizations—non-profits, government agencies, and green business associations—who work on issues related to AEC's areas of expertise. Our work products include expert testimony, analysis, modeling, policy briefs, and reports, on topics including energy and emissions forecasting, economic assessment of proposed infrastructure plans, and research on cutting-edge, flexible energy system resources.

AEC works proactively to support and promote diversity in our areas of work by providing applied, on-the-job learning experiences to graduate students—and occasionally highly qualified undergraduates—in related fields such as economics, environmental engineering, and political science. Over the past four years, AEC has hosted research assistants from Boston University, Brandeis University, Clark University, Tufts University, University of Denver, University of Massachusetts-Amherst, University of Massachusetts-Boston, University of Southern Maine, and University of Tennessee. AEC is committed to a just workplace that is diverse, pays a living wage, and is responsive to the needs of its full-time and part-time staff.

Founded in 2017 by Director and Senior Economist Elizabeth A. Stanton, PhD, AEC's talented researchers and analysts provide a unique service-minded consulting experience. Dr. Stanton has had more than two decades of professional experience as a political and environmental economist leading numerous studies on environmental regulation, alternatives to fossil fuel infrastructure, and local and upstream emissions analysis. AEC professional staff includes experts in electric, multi-sector and economic systems modeling, climate and emissions analysis, green technologies, and translating technical information for a general audience. AEC's staff are committed to addressing climate change and environmental injustice in all its forms through diligent, transparent, and comprehensible research and analysis.

I. Introduction

An integrated resource plan (IRP) is a study to determine how a power provider can best meet forecasted customer electric demand over a set period of time.[1] IRPs consider supply- and demand-side resources (central power stations, renewables, distributed energy resources, storage, and demand-side management) and develop scenarios to meet specific goals: minimizing risks, keeping costs low, or reducing environmental impacts.[2] The decisions made by the Tennessee Valley Authority (TVA) regarding its energy generation capacity are vital to the region's ability to meet climate targets and for the United States' ability to decarbonize its electric systems.

The U.S. Energy Policy Act of 1992 requires TVA to engage in a least-cost planning and selection process in which it treats supply- and demand-side resources on an equal footing basis while accounting for system operation features of those resources (such as diversity and reliability) and the ability to verify and measure energy savings from efficiency and conservation. [3] These planning processes, however, are only as good as the methods and assumptions utilized by TVA. TVA's IRPs illustrate successes and blind spots and, when examined over time, can show whether TVA is investing with science-based climate targets in mind.

TVA has a responsibility to ensure that its planning processes account for and reflect its own climate commitments over the next couple of decades. TVA's upcoming 2024 IRP is its first since committing to an 80 percent emissions reduction by 2035 from 2005 levels and to achieving net-zero emissions by 2050.[4] The 2024 IRP will also be the first since the United States established several science-based climate goals, including the commitment to limit global warming to "well below" 2 degrees Celsius pursuant to the Paris Agreement[5] and to achieve a "carbon pollution-free electricity sector no later than 2035" pursuant to multiple federal executive orders.[6] In its previous IRPs, TVA did not plan sufficiently for future

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[1] TVA. "Integrated Resource Plan." Available at: https://www.tva.com/environment/environmental-stewardship/integrated-resource-plan.

[2] Power system Engineering. "Integrated Resource Planning." Available at: https://www.powersystem.org/services/economics-rates-and-business-planning/resource-planning-and-demand-side-management/integrated-resource-planning/#:~:text=An%20Integrated%20Resource%20Plan%20(IRP,meeting%20a%20utility's%20electricity%20needs..

[3] U.S. GPO. *§831m–1. Tennessee Valley Authority least-cost planning program*. Available at: https://www.govinfo.gov/content/pkg/USCODE-2019-title16/pdf/USCODE-2019-title16-chap12A-sec831m-1.pdf.

[4] TVA. 2021. *TVA Strategic Intent and Guiding Principles.* Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/about-tva/board-of-directors/may-6-2021/strategic-plan-documentc67079e2-d479-4f3d-a13b-1fa6fd714cde.pdf?sfvrsn=bc7bb2e8_7. p. 20-22.

[5] United Nations. 2015. *Paris Agreement.* Available at: https://unfccc.int/sites/default/files/english_paris_agreement.pdf. p. 5.

[6] 1) White House. 2022. *Executive Order on the Implementation of the Energy and Infrastructure Provisions of the Inflation Reduction Act of 2022.* Available at: https://www.whitehouse.gov/briefing-room/presidential-actions/2022/09/12/executive-order-on-the-implementation-of-the-energy-and-infrastructure-provisions-of-the-inflation-reduction-act-of-2022/. 2) White House. 2021. *Executive Order on Tackling the Climate Crisis at Home and Abroad.* Available at: https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/; 3) White House. 2021. *Executive Order on Catalyzing Clean energy Industries and Jobs Through Federal Sustainability.* Available at: https://www.whitehouse.gov/briefing-room/presidential-actions/2021/12/08/executive-order-on-catalyzing-clean-energy-industries-and-jobs-through-

decarbonization. While TVA's coal capacity has fallen by 54 percent over the last several years, the addition of zero emission generation capacity has not kept pace with the addition of gas generation.

The report begins in **Section II** with a description of the Tennessee Valley Authority, its capacity and generation mix since 2011, and the role of TVA's IRPs. **Section III** examines the planning process that TVA utilizes in its IRPs to assess future resource needs and recommend planning ranges for select resources. **Section IV** compares TVA's planning ranges in its past three IRPs in 2011, 2015, and 2019 to the actual capacity additions and retirements undertaken by TVA. **Section V** presents a case study on the 2019 IRP, comparing TVA's individual resource (or site-specific) assessment methods with the integrated methodology used in TVA's IRPs and making recommendations on the use of specific methods. Finally, **Section VI** concludes with recommendations for TVA's upcoming 2024 IRP process.

II. The Tennessee Valley Authority

Established by an act of Congress in 1933, the Tennessee Valley Authority (TVA) is the largest public power provider in the United States partnering with municipal utilities and regional cooperatives) across seven states[7,8] to supply power to numerous delivery districts in Tennessee, Kentucky, Mississippi, Alabama, Georgia, North Carolina, and Virginia (see Figure 1).[9]

Out of the 153 power companies that purchase power from TVA to sell across the Tennessee Valley region, all but six are served through rolling power purchase agreements with 20-year notice of termination provisions, accounting for over 90 percent of TVA's revenue.[10,11] TVA also directly serves 58 industrial customers that together constitute 8 percent of its revenue.[12] The remaining 1 percent of TVA's revenue comes from power purchased by twelve utilities located in the Southeastern United States.[13] Through these arrangements, TVA's 29 hydroelectric sites (109 units), 14 solar sites, nine gas-fired combustion sites plants (86 units), eight gas-fired combined cycle sites (14 units), five coal-fired sites (25 units), three nuclear sites (7 units), one coal-fired co-generation unit,[14] and one pumped storage site (4 units) serve approximately 10 million people.[15]

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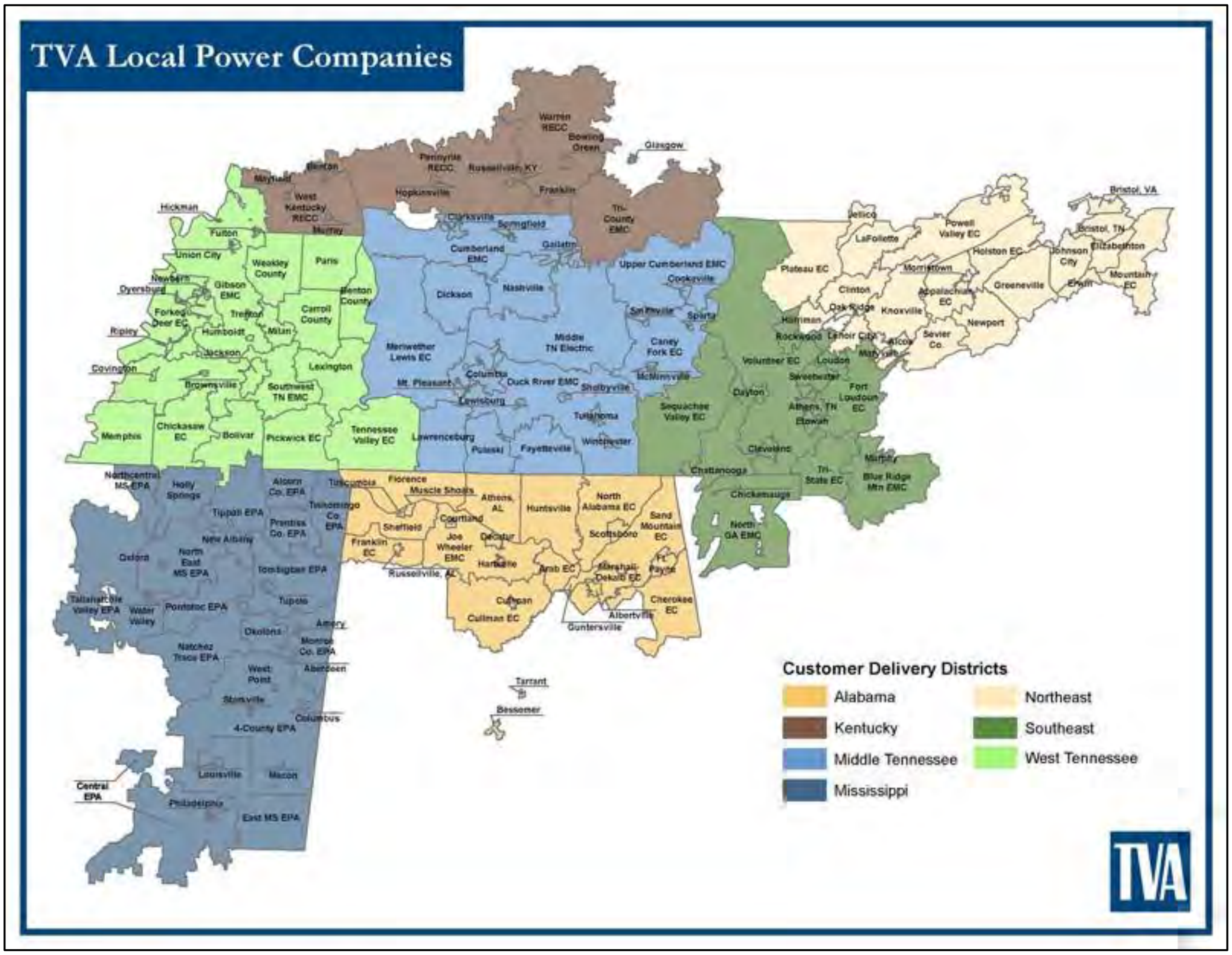
federal-sustainability/;
[7] TVA. *2019 Integrated Resource Plan Volume I – Final Resource Plan*. Available at: https://www.tva.com/environment/environmental-stewardship/integrated-resource-plan. p. 1.
[8] TVA. 2019. *Integrated Resource Plan: A Notice by the Tennessee Valley Authority.* Federal Register: 84 FR 4987. Available at: https://www.federalregister.gov/documents/2019/09/17/2019-20104/integrated-resource-plan.
[9] TVA. "TVA's Local Power Company Providers." Available at: https://www.tva.com/energy/public-power-partnerships/local-power-companies.
[10] TVA. "Public Power for the Valley." Available at: https://www.tva.com/energy/public-power-partnerships.
[11] TVA. 2022. "TVA Reports Fiscal Year 2022 Financial Results." Available at: https://www.tva.com/newsroom/press-releases/tva-reports-fiscal-year-2022-financial-results.
[12] TVA. "Public Power for the Valley." Available at: https://www.tva.com/energy/public-power-partnerships.
[13] Ibid.
[14] TVA. "Full Steam Ahead." Available at: https://www.tva.com/energy/full-steam-ahead.
[15] TVA. "Built for the People." Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/annual-report/fy21-tva-fact-sheet04b7ef82-7693-4b86-9326-8dcb612bc534.pdf?sfvrsn=19efd01f_3.

Figure 1. TVA customer delivery districts

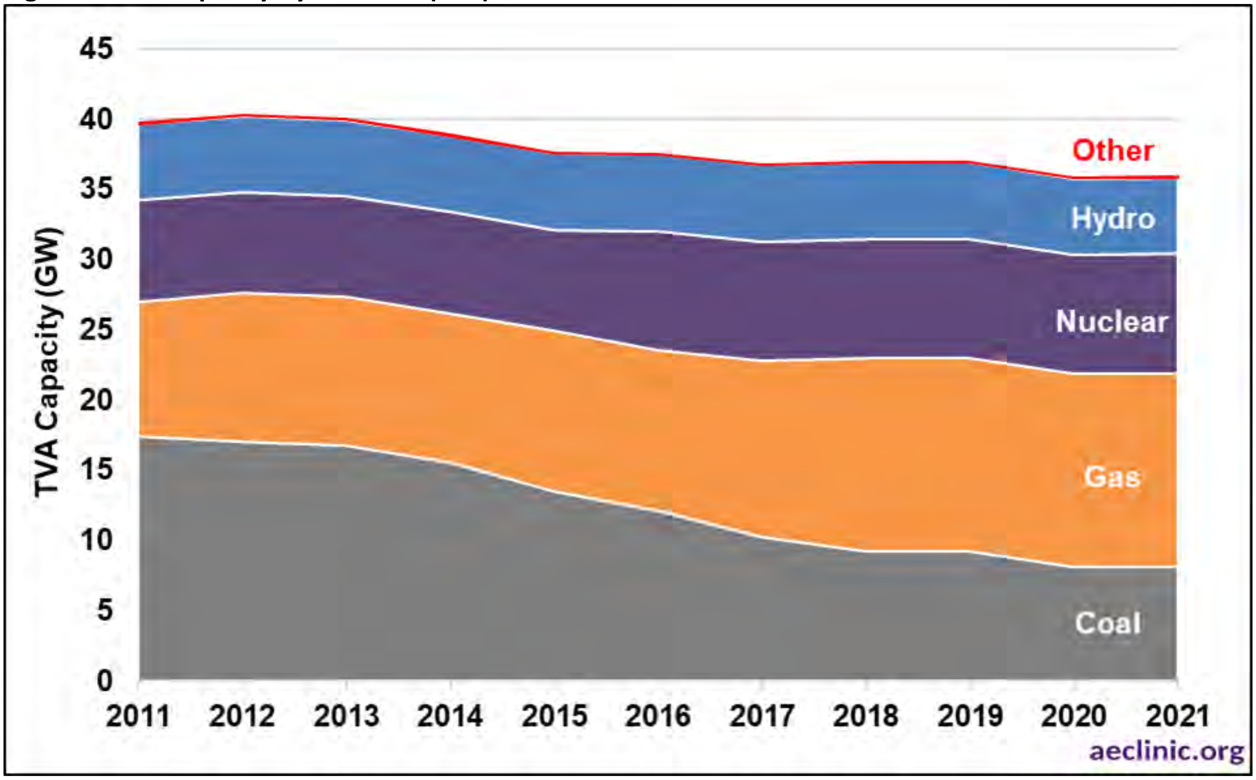


Source: Reproduced from TVA. "TVA's Local Power Company Partners." Available at: https://www.tva.com/energy/public-power-partnerships/local-power-companies.

In 2021, TVA owned 35.9 GW of electric capacity not including renewables, which has declined over time from 39.6 GW due entirely to coal retirements (see Figure 2). Gas is the single largest generating source, accounting for 38 percent (13.8 GW). Nuclear and coal respectively each account for 24 percent (8.5 GW) and 23 percent (8.0 GW), while hydroelectric capacity makes up the remaining 15 percent (5.4 GW). From 2011 to 2021, coal's share of capacity declined by nearly half, the remainder being replaced by nuclear (through the Watts Bar Nuclear Generating Station, which added 1,150 MW of electric generating capacity[16]) and gas, which increased by 44 percent between 2011 and 2021.

[16] EIA. 2016. "First new U.S. nuclear reactor in almost two decades set to begin operating." Available at: https://www.eia.gov/todayinenergy/detail.php?id=26652.

Figure 2. TVA capacity by resource (GW) from 2011 to 2021



Note: "Other" refers to oil (which drops from 27 to 23 MW between 2011 and 2021) and wind capacity (which is 2 MW from 2011 to 2021). This graph only includes data from U.S. EIA, which is incomplete with regard to TVA's solar and wind capacity.
Source: U.S. EIA. September 22, 2022. Form EIA-860 detailed data with previous form data (EIA-860A/860B). Available at: https://www.eia.gov/electricity/data/eia860/.

U.S. Energy Information Administration data on TVA's wind and solar resources is incomplete. However, TVA alludes to the available and contracted renewable capacity in other sources. In its *Renewable Highlights* document for Fiscal Year 2022, TVA claimed to have 8,264 MW of operating and contracted renewables capacity as of Fiscal Year 2022.[17] There are minimal data on how much operating solar and wind capacity TVA claims as its own. According to data compiled by the Southern Environmental Law Center (SELC) from TVA's 10-K forms[18], most of TVA's "operating capacity" is likely under power purchase contracts—rising from at least 84.3 MW of solar in 2018 to 510 MW of solar in 2022 (see Table 1). TVA has 1,240 to 1,242 MW of wind from power purchase contracts from 2018 to 2022 and also claims to have 1,828 MW of contracted power that is not yet operating in 2022, up from 53 MW in 2018.[19] As of 2022, TVA further "expects" 2,338 MW of contracted power that will be online between 2023 and 2025.[20] Note that it is also unclear whether or not the data in Table 1 are comprehensive; EIA reports TVA to have had 2

[17] TVA. *Renewable Highlights: Fiscal Year 2022.* Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/energy/valley-renewable-energy/tva-renewables-highlights-report---fiscal-year-2022.pdf?sfvrsn=41675a30_1. p. 2.
[18] SELC calculations using: TVA. "SEC Filings." Available at: https://tva.q4ir.com/financial-information/sec-filings/default.aspx.
[19] Ibid.
[20] Ibid.

MW of wind capacity from 2011 to 2021, but does not specify whether that capacity is owned or purchased. The data in Table 1 do not specify any owned wind capacity.

Table 1. TVA's operating solar and wind capacity (MW)

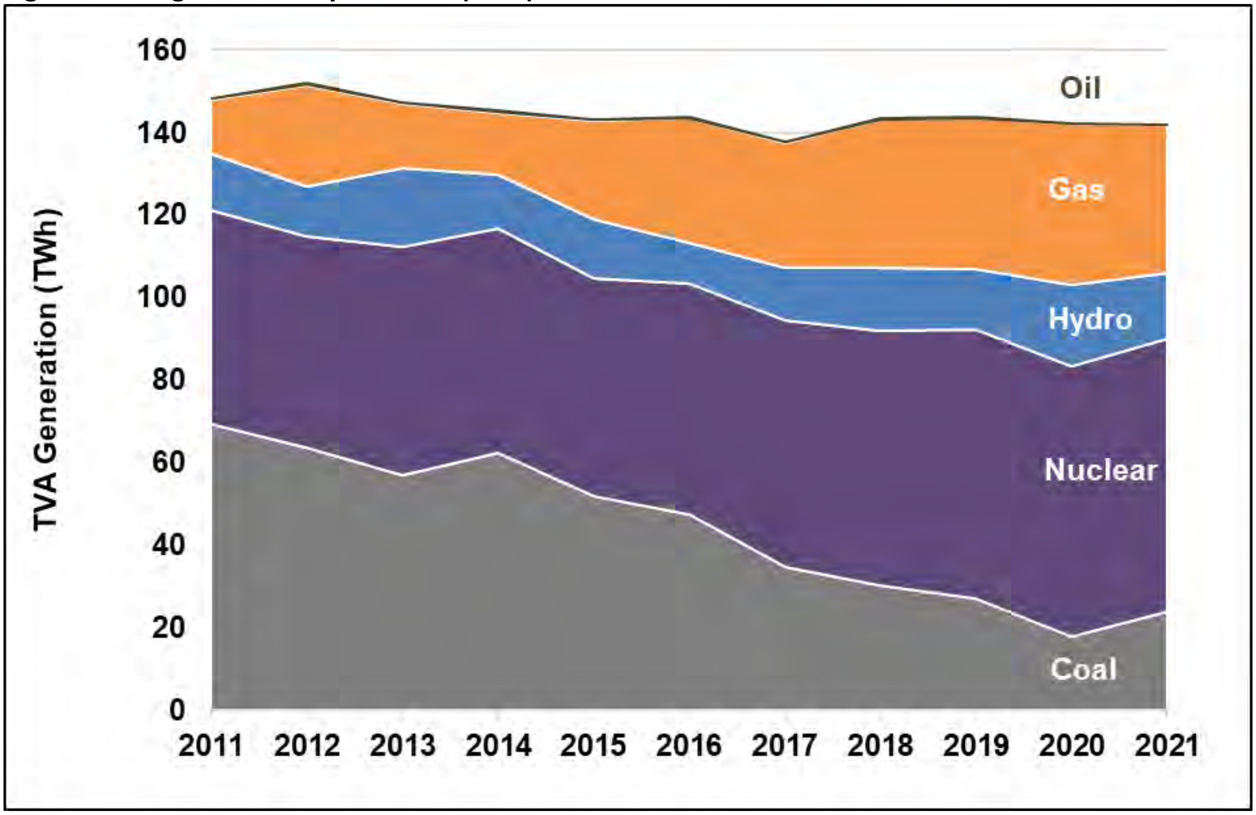
		2018	2019	2020	2021	2022
Solar	TVA-Owned	1.0	1.0	1.0	1.0	1.0
	Power Purchase Contracts	84.3	132.5	133.0	360.0	510.0
	Total	**85.3**	**133.5**	**134.0**	**361.0**	**511.0**
Wind	TVA-Owned	0.0	0.0	0.0	0.0	0.0
	Power Purchase Contracts	1,242.0	1,242.0	1,242.0	1,242.0	1,240.0
	Total	**1,242.0**	**1,242.0**	**1,242.0**	**1,242.0**	**1,240.0**

Source: SELC calculations using: TVA. "SEC Filings." Available at: https://tva.q4ir.com/financial-information/sec-filings/default.aspx.

In 2021, the largest share of TVA's generation came from nuclear at 47 percent (66.4 TWh, see Figure 3). Gas- and coal-fired resources accounted for 42 percent (or 59.6 TWh), while the remaining 11 percent (or 15.8 TWh) was generated at hydroelectric facilities (11 percent).[21] The share of nuclear generation has increased since 2011 (when it provided just 35 percent or 51.8 TWh). Hydro has also remained static in terms of its generation—providing 15.8 TWh in 2021 and 13.7 TWh in 2011 (11 and 9 percent respectively). Gas and coal have seen the most dramatic change. Coal fell from 69.4 TWh to 23.8 TWh (46.9 percent to 16.8 percent) while gas increased from 13 TWh in 2011 to 35.8 TWh in 2021 (8.8 percent to 25.3 percent). As discussed in Section III, these changes reflect TVA's unplanned coal retirements over the last decade and large-scale expansion of gas capacity.

[21] AEC calculations using: US EIA. September 22, 2022. Form EIA-860 detailed data with previous form data (EIA-860A/860B). Available at: https://www.eia.gov/electricity/data/eia860/

Figure 3. TVA generation by resource (TWh) from 2011 to 2021



Note: This graph only includes data from U.S. EIA, which is incomplete with regard to solar and wind capacity.
Source: U.S. EIA. September 22, 2022. Form EIA-923 detailed data with previous form data (EIA-906/920). Available at: *https://www.eia.gov/electricity/data/eia923/*.

TVA's climate goals

In March 2021, TVA announced its "aspiration to achieve net zero carbon emissions by 2050" in its *Strategic Intent and Guiding Principles* document.[22] In achieving this goal, TVA views "natural gas as a bridge" between coal retirements and solar expansion, and argues that gas facilitates coal retirements, solar energy expansion, and maintains system reliability and resiliency.[23] TVA also states that it is "developing a path" to approximately 80 percent carbon reduction of 2005 levels by 2035 by extending the life of the current nuclear and hydro fleets, adding 10,000 MW of solar by 2035,[24] and collaborating with local power companies to plan and leverage demand-side solutions.[25] Finally, TVA also planned to execute

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[22] TVA. 2021. *TVA Strategic Intent and Guiding Principles.* Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/about-tva/board-of-directors/may-6-2021/strategic-plan-documentc67079e2-d479-4f3d-a13b-1fa6fd714cde.pdf?sfvrsn=bc7bb2e8_7. p. 22.

[23] Ibid, 23.

[24] The solar additions that TVA highlighted as aspirations or goals in its 2021 *Strategic Intent and Guiding Principles* were published after its 2019 IRP.

[25] TVA. 2021. *TVA Strategic Intent and Guiding Principles.* Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/about-tva/board-of-directors/may-6-2021/strategic-plan-documentc67079e2-d479-4f3d-a13b-1fa6fd714cde.pdf?sfvrsn=bc7bb2e8_7. p. 22.

a 70 percent carbon reduction from 2005 levels by 2030.[26]

Since 2021, numerous federal executive orders have reiterated that federal agencies (like TVA) must prioritize, facilitate, and/or otherwise achieve a carbon pollution-free electric sector by 2035 and net-zero emissions economy-wide by no later than 2050.[27] TVA must ensure that subsequent IRPs plan future resources, additions, and retirements in line with these goals. As a federal agency, TVA is also responsible for contributing to the United States' efforts to keep global average temperature increases "well below" 2 degrees Celsius above pre-industrial levels per the 2015 Paris Agreement.[28]

TVA's IRP process

Title 16 U.S. Code § 831m-1 of the Energy Policy Act of 1992[29] requires TVA to "employ and implement a planning and selection process for new energy resources which evaluates the full range of existing and incremental resources (including new power supplies, energy conservation, and efficiency, and renewable energy resources) in order to provide adequate and reliable service" to TVA customers at the "lowest system cost."[30] The federally mandated planning process must account for:[31]

- Features of system operation: diversity, reliability, dispatchability, and other risk factors;
- Energy savings through conservation and efficiency; and
- Treatment of demand and supply resources "on a consistent and integrated basis."

In addition, the Tennessee Valley Authority Act of 1933 requires TVA's power system to be self-financing, operate as a nonprofit, and sell power at rates as low as feasible.[32]

TVA conducts its required planning process through IRPs,[33] long-term plans for the next 20 years of TVA

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[26] Ibid, p. 21.
[27] 1) White House. 2022. *Executive Order on the Implementation of the Energy and Infrastructure Provisions of the Inflation Reduction Act of 2022.* Available at: https://www.whitehouse.gov/briefing-room/presidential-actions/2022/09/12/executive-order-on-the-implementation-of-the-energy-and-infrastructure-provisions-of-the-inflation-reduction-act-of-2022/. 2) White House. 2021. *Executive Order on Tackling the Climate Crisis at Home and Abroad.* Available at: https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/; 3) White House. 2021. *Executive Order on Catalyzing Clean energy Industries and Jobs Through Federal Sustainability.* Available at: https://www.whitehouse.gov/briefing-room/presidential-actions/2021/12/08/executive-order-on-catalyzing-clean-energy-industries-and-jobs-through-federal-sustainability/;
[28] United Nations. 2015. *Paris Agreement.* Available at: https://unfccc.int/sites/default/files/english_paris_agreement.pdf. p. 5.
[29] United States Code Annotated. *Title 16 § 831-m: Tennessee Valley Authority least-cost planning program*. WestLaw.
[30] Ibid, p. 1.
[31] Ibid, p. 1.
[32] 1) TVA. 2019. *Integrated Resource Plan: A Notice by the Tennessee Valley Authority.* Federal Register: 84 FR 4987. Available at: https://www.federalregister.gov/documents/2019/09/17/2019-20104/integrated-resource-plan; 2) United States Code Annotated. *Title 16 § 831-m: Tennessee Valley Authority least-cost planning program*. WestLaw. p. 4.
[33] TVA. 2019. *Integrated Resource Plan: A Notice by the Tennessee Valley Authority.* Federal Register: 84 FR 4987.

capacity, the goal of which is to identify a resource plan that functions well under different future conditions and accounts for metrics such as costs, risks, or environmental factors.[34] In this report, we review IRPs prepared by TVA in 2019,[35] 2015,[36] and 2011.[37] TVA's next IRP is expected to be completed by the end of 2024.[38] TVA's IRPs are accompanied with Environmental Impact Statements (EIS), as required under the U.S. National Environmental Policy Act of 1970.[39] Rather than providing a recommended or preferred resource plan, TVA IRPs to date have developed prospective ranges for capacity additions and retirements over 20-year planning periods (see Table 2)[40] based on a collection of scorecard-based metrics that include cost, financial risk, operational flexibility, macroeconomic effects, or environmental impacts or stewardship.[41] The IRPs publish a low- and high-end for capacity additions and retirements (together constituting a planning range). In the 2015 and 2019 IRPs TVA publishes planning ranges ten years and twenty years out from when the IRP calculations were undertaken. The "actual" column displays the addition to TVA capacity through 2021 for the given resource from TVA capacity in the IRP year. Blank spaces in the "Actual" column denote lack of sufficient data to calculate changes in capacity between the respective IRP year and 2021—the latest year available for EIA data. The "actual" column does not incorporate changes in capacity that have not yet occurred (i.e. anticipated additions or retirements). For a discussion of how TVA continues to prioritize gas in its site-specific decision-making see Section V.

Available at: https://www.federalregister.gov/documents/2019/09/17/2019-20104/integrated-resource-plan.

[34] TVA. *2019 Integrated Resource Plan Volume I – Final Resource Plan*. Available at: https://www.tva.com/environment/environmental-stewardship/integrated-resource-plan. p. ES-1.

[35] Ibid, p. 1.

[36] TVA. *Integrated Resource Plan: 2015 Final Report*. Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/irp/documents/2015_irp.pdf?sfvrsn=4892374_0.

[37] TVA. 2011. *Integrated Resource Plan: TVA's Environmental & Energy Future.* Available at: https://www.nrc.gov/docs/ML1217/ML12171A189.pdf.

[38] TVA. 2023. "TVA Engaging Public for Input on Next Integrated Resource Plan." Available at: https://www.tva.com/newsroom/press-releases/tva-engaging-public-for-input-on-next-integrated-resource-plan.

[39] TVA. *2019 Integrated Resource Plan: Executive Summary*. Available at: https://www.tva.com/environment/environmental-stewardship/integrated-resource-plan. p. 2.

[40] TVA. 2019. *Integrated Resource Plan: A Notice by the Tennessee Valley Authority.* Federal Register: 84 FR 4987. Available at: https://www.federalregister.gov/documents/2019/09/17/2019-20104/integrated-resource-plan.

[41] TVA. 2019. *Integrated Resource Plan: A Notice by the Tennessee Valley Authority.* Federal Register: 84 FR 4987. Available at: https://www.federalregister.gov/documents/2019/09/17/2019-20104/integrated-resource-plan. p. 6-14.

Table 2. Summary of TVA planning ranges and capacity changes

IRP Year	Capcity Additions and Retirements	Planning Ranges (MW)		Timeframe	Actual
		Low	High		
2011	EEDR	3,600	5,100	2020	
	Renewable	1,500	2,500	2020	
	Coal-fired capacity idled	2,400	4,700	2017	
	Storage	850	850	2020-2024	0
	Nuclear	1,150	5,900	2013-2029	1,343
	Coal	0	900	2025-2029	-9,327
	Gas	900	9,300	2012-2029	4,178
2015	Demand Response	450	575	2023	
	Energy Efficiency	900	1,300		
	Wind	0	0		
	Solar	150	800		
	Hydro	50	50		0
	Nuclear	800	800		1,343
	Coal	0	0		-5,398
	Gas	700	2,300		2,331
	Demand Response	450	575	2033	
	Energy Efficiency	2,000	2,800		
	Wind	500	1,750		
	Solar	3,150	3,800		
	Hydro	50	50		0
	Nuclear	800	800		1,343
	Coal	0	-3,400		-5,398
	Gas	3,900	5,500		2,331
2019	Demand Response	0	0	2028	
	Energy Efficiency	0	1,800		
	Wind	0	1,800		0
	Solar	1,500	8,000		228
	Hydro	0	0		0
	Storage	0	2,400		
	Nuclear	0	0		74
	Coal	-2,100	-2,100		-1,150
	Gas - Combustion Turbine	-2,000	5,200		0
	Gas - Combined Cycle	-800	5,700		0
	Demand Response	0	500	2038	
	Energy Efficiency	0	2,200		
	Wind	0	4,200		0
	Solar	1,500	14,000		228
	Hydro	0	175		0
	Storage	0	5,300		
	Nuclear	0	0		74
	Coal	-2,100	-2,100		-1,150
	Gas - Combustion Turbine	-2,000	8,600		0
	Gas - Combine Cycle	-800	9,800		0

Note: The long-term planning ranges (2038 for the 2019 IRP and 2033 for the 2015 IRP) are inclusive of the short-term planning ranges (2028 for the 2019 IRP and 2023 for the 2015 IRP).
Source: 1) TVA. 2011. Integrated Resource Plan: TVA's Environmental & Energy Future. Available at: https://www.nrc.gov/docs/ML1217/ML12171A189.pdf.; 2) TVA. Integrated Resource Plan: 2015 Final Report. Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/irp/documents/2015_irp.pdf?sfvrsn=4892374_0.; 3) TVA. 2019. Integrated Resource Plan: A Notice by the Tennessee Valley Authority. Federal Register: 84 FR 4987. Available at:

https://www.federalregister.gov/documents/2019/09/17/2019-20104/integrated-resource-plan.; 4) U.S. EIA. September 22, 2022. Form EIA-860 detailed data with previous form data (EIA-860A/860B). Available at: https://www.eia.gov/electricity/data/eia860/; 5) U.S. EIA. September 22, 2022. Form EIA-923 detailed data with previous form data (EIA-906/920). Available at: https://www.eia.gov/electricity/data/eia923/.

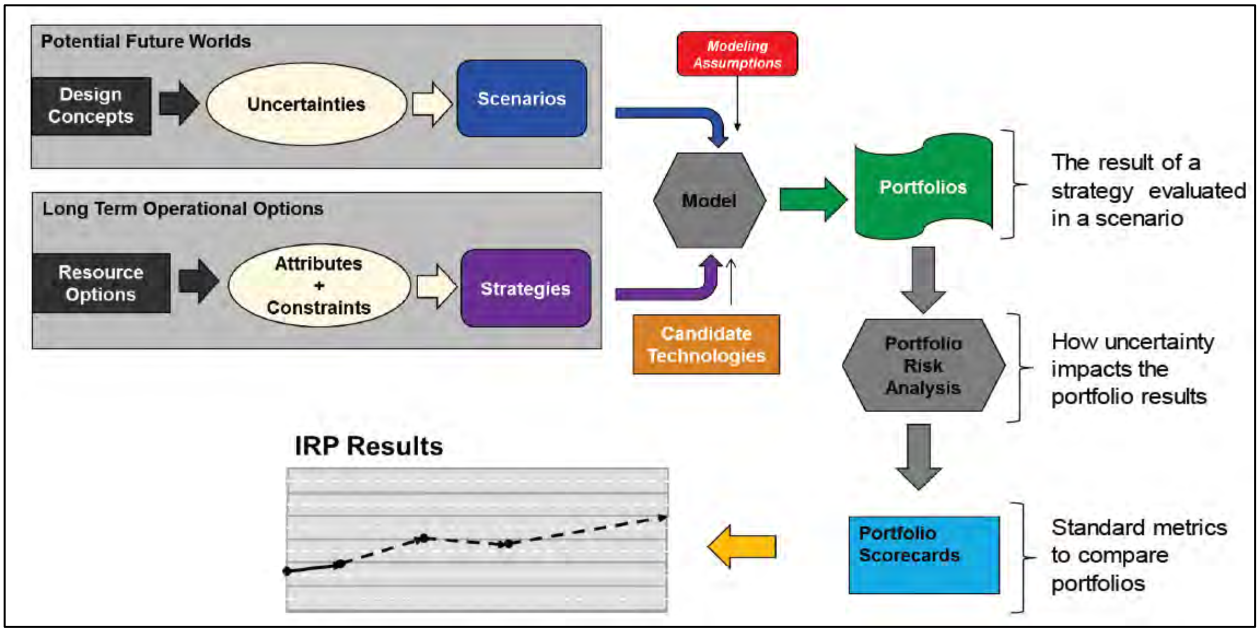
III. TVA's Planning Methods

In general, the goal of an IRP process is to facilitate the determination of a utility's future resource additions and retirements based on criteria such as the needs of the electric system, future demand, and environmental and climate goals. Once designed and approved, an IRP can function as a reference point in evaluating future resource decisions. TVA identifies the resources to include in its investment strategies, assesses multiple possible investment strategies, and then creates ranges of capacity additions or retirements for each strategy under different conditions. Throughout its planning process, TVA does not make publicly available the assumptions, parameters, and other modeling details used to arrive at the results. This black box approach makes it difficult to disentangle how TVA arrived at specific results, including its final recommended planning ranges. All three of TVA's previous IRPs (2011, 2015, and 2019) describe the use of a similar planning processes (see Figure 4).

1. TVA forecasts customer peak electric demand, including an additional reserve amount for contingencies.
2. TVA determines its existing and expected future power supply, or peak capacity.
3. TVA calculates a "capacity gap" between available supply and expected demand.
4. TVA creates possible scenarios representing futures that are not in its control and strategies based on business decisions that are in its control.
5. TVA models the least-cost combination of resources that would meet demand.
6. TVA analyzes its proposed portfolios to determine their financial, operational, and environmental impacts.
7. TVA subjects its portfolios to sensitivity analysis to test their robustness to supply and demand disruptions, market conditions, weather, technological improvements, and economic cycles;[42]
8. TVA compares portfolios based on a series of scorecard metrics.
9. TVA summarizes the results of the analysis in Steps 5 - 7 and presents ranges of recommended resource adoption and retirement for short- and long-term capacity expansion. TVA does not make a determination at the end of its IRPs as to how it will act on the published planning ranges.

[42] Ibid, p. 6-10.

Figure 4. TVA planning process



Source: Reproduced from TVA. 2019 Integrated Resource Plan Volume I – Final Resource Plan. Available at: https://www.tva.com/environment/environmental-stewardship/integrated-resource-plan. p. 6-1.

This section reviews these steps in more detail in the TVA context and provides examples from each IRP.

Estimating a capacity gap: Steps 1 – 3

The 2011, 2015 and 2019 TVA IRPs estimate electric demand, supply, and a capacity gap using three steps:

1. **Peak demand:** Future demand for the IRP models is determined using projections of long-term growth in electric sales and peak demand based on quantitative models that link sales to factors driving growth, including economic activity, electric rates, and customer retention.[43]
2. **Power supply:** TVA then identifies what generating capacity is available to it today and in the near future—the available power supply—by examining TVA-owned resources, budgeted and approved projects, updates to existing assets, and its existing power purchase agreements.[44]
3. **Capacity gap:** TVA calculates its "capacity gap:"[45] the difference between TVA's peak demand (including its reserve requirement) and its power supply.[46]

[43] TVA. *Integrated Resource Plan: 2015 Final Report*. Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/irp/documents/2015_irp.pdf?sfvrsn=4892374_0. p. 26.
[44] Ibid, p. 30.
[45] Also known as the "energy gap." Ibid, p. 33.
[46] Ibid, p. 33.

Creating portfolios: Steps 4 – 5

TVA constructs a series of alternative possible future scenarios with different economic, regulatory, technological, and social conditions that are not under TVA's control.[47] TVA then develops multiple possible business strategies.[48] A portfolio represents the resulting capacity addition plan from the application of a TVA business strategy to a scenario.[49]

TVA's 2019 IRP presents five scenarios:

- a current outlook scenario with modest growth and increasing efficiencies with little or no load growth;
- a scenario with an economic downturn;
- large-scale load growth scenario in the Tennessee Valley;
- a scenario with rapid policy-induced reduction in greenhouse gas emissions,
- increasing consumer demand for distributed energy resources (DERs); and
- a scenario in which new large-scale nuclear capacity is curtailed in favor of other options.[50]

TVA's 2019 IRP developed business strategies included:

- a base case retaining TVA's existing assumptions on cost trajectories;
- a move towards promoting DERs;
- an emphasis on investment in smaller units of capacity to promote operational flexibility;
- promoting electrification and demand management to control load shape; and
- promoting renewables at all scales.[51]

Each scenario-strategy combination (thirty in total) in TVA's 2019 IRP was used to develop a portfolio of resource additions and retirements which are then subjected to modeling (see Table 3). Each scenario-strategy combination represents a portfolio of potential capacity changes for TVA to make in response to the development of the capacity gap, conditions in the economy, policy, and electricity markets. TVA's next step is to determine the exact amount of capacity changes represented by those portfolios.

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[47] TVA. *2019 Integrated Resource Plan Volume I – Final Resource Plan*. Available at: https://www.tva.com/environment/environmental-stewardship/integrated-resource-plan. p. 2-1.
[48] TVA. *Integrated Resource Plan: 2015 Final Report*. Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/irp/documents/2015_irp.pdf?sfvrsn=4892374_0. p. 12.
[49] Ibid, p. 12.
[50] TVA. *2019 Integrated Resource Plan Volume I – Final Resource Plan*. Available at: https://www.tva.com/environment/environmental-stewardship/integrated-resource-plan. p. 2-1.
[51] Ibid, p. 2-2.

Table 3. TVA's 2019 scenario-strategy combinations (portfolios)

Scenarios	Strategies				
	A: Base Case	B: Promote DER	C: Promote Resiliency	D: Promote Efficient Load Shape	E: Promote Renewables
1: Current Outlook	1A	1B	1C	1D	1E
2: Economic Downturn	2A	2B	2C	2D	2E
3: Valley Load Growth	3A	3B	3C	3D	3E
4: Decarbonization	4A	4B	4C	4D	4E
5: Rapid DER Adoption	5A	5B	5C	5D	5E
6: No Nuclear Extensions	6A	6B	6C	6D	6E

Source: Reproduced from TVA. 2019 Integrated Resource Plan Volume I – Final Resource Plan. Available at: https://www.tva.com/environment/environmental-stewardship/integrated-resource-plan. p. 7-1.

Assessing the portfolios: Steps 6 – 8

TVA models each resource portfolio for cost effectiveness, technical potential, fuel requirements, and operating limits.

The portfolios' precise capacity expansions are determined using a resource expansion optimization model called System Optimizer[52] from ABB that minimizes the cumulative present value of total revenue requirements (PVRR) subject to a series of constraints selected by TVA including limitations on the balance of supply and demand, the energy balance, the reserve margin, generation and transmission operation, fuel purchases and utilization, new resource capital and operating costs, existing resource and operating costs, fuel prices, and the pace of distributed generation and storage adoption.[53] Optimal (or least-cost) modeling results are strongly dependent on the modeler's selection of parameter values and other settings; different selections would lead to a different "optimal" result. TVA specifies modifications to the constraints for optimization for each scenario-strategy pairing. System Optimizer uses a dispatch methodology for the 20 years of the IRP (the study period) and a "representative hours" approach in which the generation and load (the amount of electricity demanded over a period of time) values for given periods in a week are scaled to span entire weeks, and days in a month. The capacity path with the lowest PVRR—based on TVA's parameter selections—becomes the optimized capacity plan or portfolio.

Each capacity portfolio is then subject to a financial analysis using the MIDAS[54] hourly production cost model that determines a PVRR with additional variables such as cash flows associated with financing over the full 20-year study period.[55] The model also calculates a system average costs to gauge the rate impacts

[52] ABB. "Adaptable, integrated optimization." Available at: https://new.abb.com/power-generation/solutions/power-plant-optimization.

[53] TVA. *2019 Integrated Resource Plan Volume I – Final Resource Plan*. Available at: https://www.tva.com/environment/environmental-stewardship/integrated-resource-plan,p. 6-9.

[54] ABB. "Adaptable, integrated optimization." Available at: https://new.abb.com/power-generation/solutions/power-plant-optimization.

[55] TVA. *Integrated Resource Plan: 2015 Final Report*. Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/irp/documents/2015_irp.pdf?sfvrsn=4892374_0. p. 63.

of a given portfolio.[56] TVA discounted future costs and revenue at 8 percent in the 2019 IRP,[57] the 2015 IRP,[58] and the 2011 IRP.[59]

The capacity portfolios are then subject to analysis to assess the sensitivity of modeling results to changes in key variables. In the 2019 IRP, for example, the variables used to assess uncertainty included: the prices of natural gas and coal, financial parameters like interest rates or operation and maintenance costs, and net sales forecast uncertainty for peak and energy (including demand, energy efficiency, electrification, behind-the-meter-solar, and combined heat and power).[60]

Each portfolio's performance is compared using a standardized series of metrics gathered in a scorecard. The 2019 scorecard's metrics included PVRR, CO_2 emissions, waste consumption of water, and per capita income for the Tennessee Valley among others (see Table 4).

[56] Ibid.

[57] Ibid, p. 6-9.

[58] TVA. *Integrated Resource Plan: 2015 Final Report*. Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/irp/documents/2015_irp.pdf?sfvrsn=4892374_0. p. 63.

[59] TVA. 2011. *Integrated Resource Plan: TVA's Environmental & Energy Future.* Available at: https://www.nrc.gov/docs/ML1217/ML12171A189.pdf. p. 100.

[60] TVA. *2019 Integrated Resource Plan Volume I – Final Resource Plan*. Available at: https://www.tva.com/environment/environmental-stewardship/integrated-resource-plan,p. 6-12.

Table 4. TVA 2019 IRP Scorecard

Category	Metric	Formula
Cost	PVRR ($Bn)	Present Value of Revenue Requirements over Planning Period
	Total Resource Cost ($Bn)	PVRR + Participant cost net of savings (bill savings, tax credits)
	System Average Cost ($/MWh)	$\frac{\text{NPV Rev Reqs (2019–2038)}}{\text{NPV Sales (2019–2038)}}$
Risk	Risk/Benefit Ratio	$\frac{\text{95th}_{(PVRR)} - \text{Expected}_{(PVRR)}}{\text{Expected}_{(PVRR)} - \text{5th}_{(PVRR)}}$
	Risk Exposure ($Bn)	95th Percentile $_{(PVRR)}$
Environmental Stewardship	CO2 (MMTons)	Average Annual Tons of CO2 Emitted During Planning Period
	CO2 Intensity (lbs/MWh)	$\frac{\text{Pounds CO2 (2019–2038)}}{\text{MWh Generated \& Purchased (2019–2038)}}$
	Water Consumption (MMGallons)	Average Annual Gallons of Water Consumed During Planning Period
	Waste (MMTons)	Average Annual Tons of Coal Ash and Scrubber Residue During Planning Period
	Land Use (Acres)	Acreage Needed for Expansion Units in Each Portfolio (2038)
Operational Flexibility	Flexible Resource Coverage Ratio	$\frac{\text{Flexible Capacity Available for Max 3-Hour Ramp in each Strategy (2038)}}{\text{Capacity Required for Max 3-Hour Ramp in each Scenario (2038)}}$
	Flexibility Turn Down Factor	$\frac{\text{"Must Run" + "Non-Dispatchable" (2038)}}{\text{Sales (2038)}}$
Valley Economics	Percent Difference in Real Per Capita Income	Percent Difference in Real Per Capita Personal Income Compared to the Base Case (for each scenario)
	Percent Difference in Employment	Percent Difference in Non-Farm Employment Compared to the Base Case

Source: Reproduced from TVA. 2019 Integrated Resource Plan Volume I – Final Resource Plan. Available at: https://www.tva.com/environment/environmental-stewardship/integrated-resource-plan, p. 6-15.

TVA's recommended capacity ranges: Step 9

Finally, TVA selects among the resource portfolios modeling to recommend capacity additions and retirements for each resource type. In contrast to the widely used practice of utility IRPs determining a single "preferred portfolio," TVA does not select a single portfolio or overall strategy in the recommendations of any of its IRPs. Instead, TVA publishes power supply ranges without making a specific recommendation based on prospective schedules of additions and retirements of each resource type. In its 2019 IRP, TVA's "target power supply ranges" represent the resulting minimum and maximum addition or retirement possibilities in the "current outlook scenario."[61] In its 2015 IRP, TVA's recommended power supply ranges draw from analysis on strategies that do not emphasize meeting needs with a specific resource type (i.e. TVA did not use strategies in a way that would "place specific targets on particular resource types"—for example, energy efficiency and renewables).[62] In both cases, TVA delineates the

[61] TVA. *2019 Integrated Resource Plan Volume I – Final Resource Plan*. Available at: https://www.tva.com/environment/environmental-stewardship/integrated-resource-plan. p. 9-2.
[62] TVA. *Integrated Resource Plan: 2015 Final Report*. Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/irp/documents/2015_irp.pdf?sfvrsn=4892374_0. p. 115.

circumstances in which analysis on its various portfolios ultimately contributes to the planning ranges it displays. Other electric utilities commonly use IRPs to recommend a single portfolio. A few examples, among many, of this practice are:

- The Northern Indiana Public Service Company's 2018 IRP selected a preferred plan among its various portfolios and provides a year-by-year snapshot of its chosen energy portfolio (Portfolio F)—the purchases leading up to which include solar, wind, battery storage, market purchases, and demand-side management—through 2038;[63]
- PacificCorp, in their 2023 IRP, publishes exact schedules for the retirement of coal and gas plans for their prospective resource mix from 2023 to 2052;[64]

TVA's failure to make firm recommendations on capacity addition and retirement limits the degree to which its IRPs can be treated as reliable indicators of TVA's future plans or metrics against which to compare TVA's past investments. For example, the 2019 IRP does not select portfolios constructed from the "Current Outlook" scenario, undermining evaluations of whether TVA is actually achieving a least-cost portfolio or aiming to achieve decarbonization goals. This lack of firm recommendations also limits the IRP's ability to function as a planning tool, as the capacity ranges proposed by TVA have been large—leaving open a broad set of plausible capacity additions or retirements. It may also result in ad hoc decision-making as TVA has no other benchmark for capacity additions beyond large ranges that can accommodate numerous conflicting possibilities, strategic investments (or lack thereof), and costs. There is little investigation of the feasibility of different capacity additions, nor of "all resource RFPs" that might solicit resources to meet TVA's target ranges. TVA also omits detailed timelines for the planned addition or retirement of resources, noting only that the ranges of additions and retirements should be met within five or ten years of the publication of the IRP.

IV. Comparing TVA's planning process to its evolving resource mix

TVA's additions and retirements planning ranges provide an overview of TVA's priorities over the last decade, in particular the extent to which TVA has shifted from coal- to gas-based generation. This section compares TVA's actual additions and retirements between 2011 and 2021 to the plans outlined in its 2011, 2015, and 2019 IRPs. The IRPs failed to:

- anticipate the size of coal retirements;
- limit the planned or actual growth of gas capacity; and
- plan adequately for a decarbonized gas system following 2019.

TVA's actual capacity additions and retirements can be calculated by subtracting its latest available

[63] NIPSCO. 2018. *Northern Indiana Public Service Company LLC Integrated Resource Plan.* Available at: https://www.nipsco.com/docs/librariesprovider11/rates-and-tariffs/irp/2018-nipsco-irp.pdf?sfvrsn=15. p. 172
[64] PacifiCorp. 2023. *2023 Integrated Resource Plan: Volume I.* Available at: https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/energy/integrated-resource-plan/2023-irp/2023_IRP_Volume_I.pdf. p. 146-147.

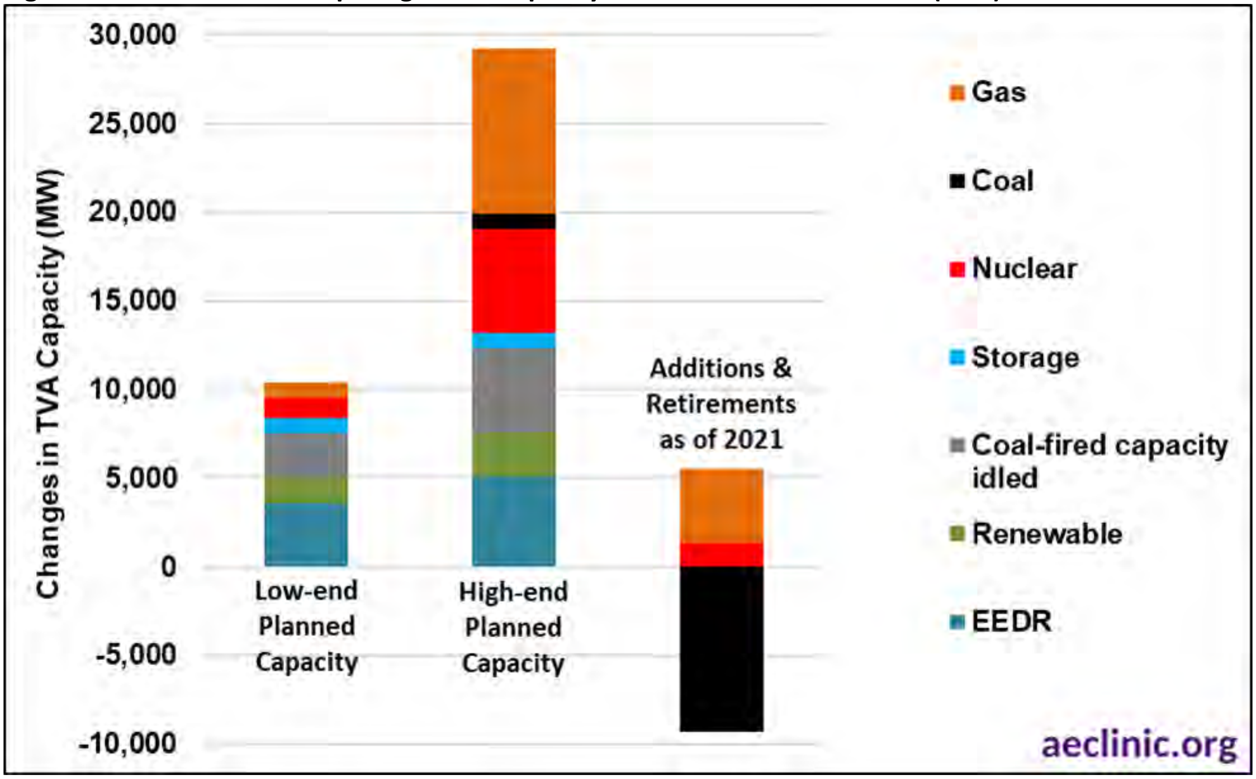
capacity data (2021) from the TVA capacity additions or retirements planned in the year the IRP was published (2011, 2015, or 2019). For example, TVA's gas capacity increased from 9,607 MW to 13,786 MW—resulting in an actual capacity additions of 4,178 MW. Comparing the actual capacity additions and retirements to their planned values can illustrate the extent of TVA's commitment to previous plans and the quality of assumptions or other aspects of the planning process. However more specific statements about their commitments to a particular strategy are precluded by TVA's lack of portfolio selection and opaque methods.

TVA publishes both short- (ten-year) and long-term (20-year) planning ranges in each of its IRPs (see Figure 5 through Figure 7). These planning ranges denote the amount of resource capacity TVA expects to add, idle, or retire by a given target year.

TVA's 2011 IRP failed to plan for coal retirements

Unlike later IRPs, the 2011 IRP planned for no coal retirements whatsoever; 2,400 MW to 4,700 MW of TVA's total 17,407 MW of coal capacity was planned to be idled through 2033 (see Figure 5). By 2021, TVA had already retired 9,327 MW of coal since 2011. TVA's additions (through 2021) of gas and nuclear are still within the 2011 IRP planned range: TVA has already added 4,178 MW of gas, 44 percent of the 2011 IRP's high-end goal for gas additions by 2029; and 1,343 MW of nuclear, 167 percent of the high-end goal for the period 2012-2029. The IRP did not anticipate the coal retirements that would occur in the coming decade and did not plan its other capacity additions accordingly. In fact, its high-end planning allows for a 900 MW addition of coal capacity. A full accounting of the reasons for TVA's failure to anticipate coal retirements would require further analysis, but the failure itself is indicative of a planning process with inaccurate load projections and/or mistaken core inputs or assumptions regarding coal's feasibility, cost, or environmental effects.

Figure 5. TVA 2011 IRP comparing actual capacity additions and retirements (MW)



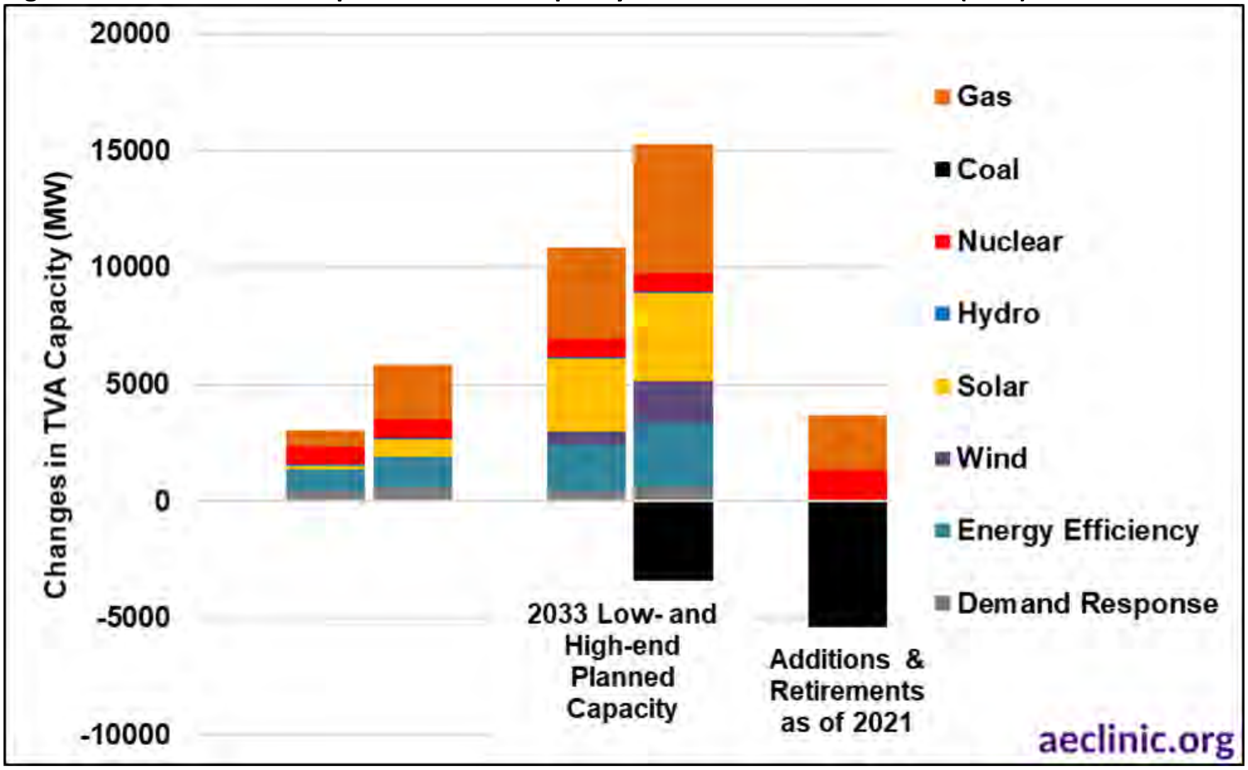
Note: Renewable capacity additions are not included in this graph due to a lack of available data on operating renewable capacity prior to 2018. High-end and low-end planned capacity are the maximum and minimums respectively for the resource planning ranges TVA proposes in its 2011 IRP. Finally, there are no specific timeframes for low-end and high-end planned capacity displayed in this figure because TVA assigns different timeframes to each resource (see Table 2).

Source: 1) TVA. 2011. Integrated Resource Plan: TVA's Environmental & Energy Future. Available at: https://www.nrc.gov/docs/ML1217/ML12171A189.pdf; 2) US EIA. September 22, 2022. Form EIA-923 detailed data with previous form data (EIA-906/920). Available at: https://www.eia.gov/electricity/data/eia923/.

TVA's 2015 IRP: expanding gas and nuclear

TVA' 2015 IRP planned for larger and more explicit commitments to specific renewables, such as wind and solar, and a firmer commitment to coal retirements (rather than idling coal capacity) (see Figure 6). TVA's coal retirements (2,331 MW since 2015) continued to greatly outpace its high-end predictions for both 2023 and 2033 in the 2015 IRP. Gas capacity additions by 2021 outpace the high end planned capacity additions through 2023 (2,331 MW of added gas capacity compared to no planned additions for 2023). The nuclear capacity added since 2015 exceeds the high end of planned capacity through 2023 and 2033 (both 800 MW). Once again, TVA underestimated the scale of subsequent coal retirements. Finally, while TVA does show expanded ranges for solar and wind capacity (previously combining them as "renewable" capacity in the 2011 IRP), the Authority provides insufficient data to assess the degree to which TVA's capacity fell within these planning ranges (see Table 1 for the data that are available via TVA's filings with the Securities and Exchange Commission (SEC)).

Figure 6. TVA 2015 IRP compared to actual capacity additions and retirements (MW)



Note: Gas in this figure is inclusive of both combustion turbine and combined cycle units. Data on renewable capacity additions are not included in this graph due to a lack of available data on operating renewable capacity prior to 2018. Planned capacity for 2033 is cumulative (i.e. includes the bars for 2023).

Source: 1) TVA. Integrated Resource Plan: 2015 Final Report. Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/irp/documents/2015_irp.pdf?sfvrsn=4892374_0.; 2) US EIA. September 22, 2022. Form EIA-923 detailed data with previous form data (EIA-906/920). Available at: https://www.eia.gov/electricity/data/eia923/.

TVA's 2019 IRP: A defunct IRP

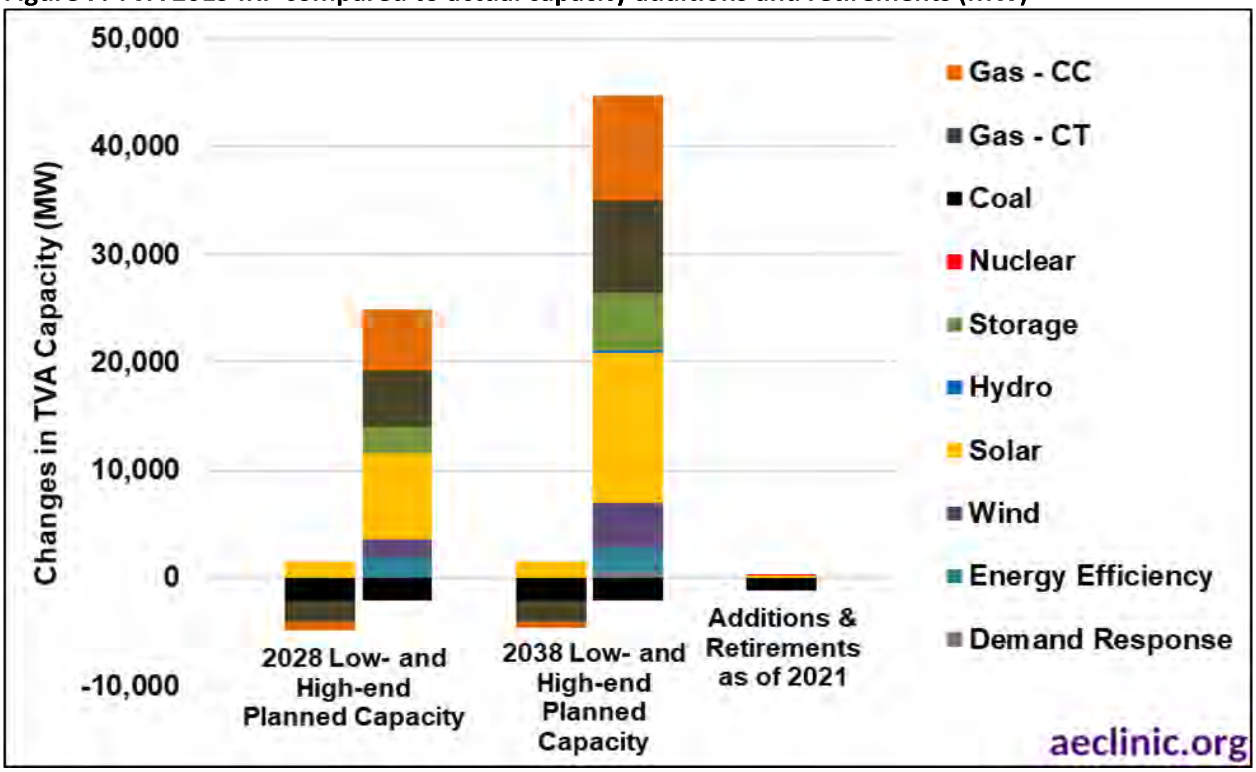
TVA's 2019 IRP plans for an acceleration of gas and solar capacity additions relative to the 2015 and 2011 IRPs (see Figure 7). As only two years passed between 2019 and the latest year of available capacity data from EIA, there is little to compare between actual and planned capacity changes. TVA has already retired 1,150 MW of coal—it planned to retire 2,100 MW at most by 2038—only promising to "evaluate" additional retirements of up to 2,200.[65] TVA also greatly expanded the scale of its gas planning ranges. The high-end planned capacity for 2028 and 2038 respectively is -2,000 to 8,600 for combustion turbines and -800 to 9,800 MW for combined cycle plants, together more than triple the high-end planned capacity for gas set in the 2015 IRP (2,300 MW for 2023 and 5,500 MW for 2033). TVA added 275.7 MW of solar capacity between 2018 and 2021, and another 150 MW by 2022—all of which was acquired through power

[65] TVA. *2019 Integrated Resource Plan Volume I – Final Resource Plan*. Available at: https://www.tva.com/environment/environmental-stewardship/integrated-resource-plan. p. ES-4.

purchase contracts.[66] TVA has not added new owned- or purchased-wind capacity.[67] There is no schedule or chart tracking prospective gas additions, making it infeasible to assess the viability of gas additions at this scale (TVA has announced a number of specific gas additions since the IRP that can be used for comparison such as Kingston[68] and Cheatham[69].)

Finally, the 2021 announcement of TVA's net zero goal by 2050 renders the 2019 IRP defunct. Further, TVA cannot meet its obligations under the Paris Agreement or Federal executive orders based on this plan, due to the scale of planned gas additions.

Figure 7. TVA 2019 IRP compared to actual capacity additions and retirements (MW)



Note: Planned capacity for 2038 encompasses planned capacity for 2028.
Source: 1) TVA. 2019 Integrated Resource Plan Volume I – Final Resource Plan. Available at: https://www.tva.com/environment/environmental-stewardship/integrated-resource-plan..; 2) US EIA. September 22, 2022. Form EIA-923 detailed data with previous form data (EIA-906/920). Available at: https://www.eia.gov/electricity/data/eia923/.

Takeaways from the IRPs

Based on the assessment of TVA's planning process and the comparison of additions and retirements for

[66] SELC calculations using: TVA. "SEC Filings." Available at: https://tva.q4ir.com/financial-information/sec-filings/default.aspx.
[67] Ibid.
[68] TVA. 2023. "Kingston Fossil Plant Retirement." Available at: https://www.tva.com/environment/environmental-stewardship/environmental-reviews/nepa-detail/kingston-fossil-plant-retirement.
[69] TVA. 2023. "Cheatham County Generation Site." Available at: https://www.tva.com/environment/environmental-stewardship/environmental-reviews/nepa-detail/cheatham-county-generation-site.

each respective IRP:

1. TVA does not plan to halt the increase in gas capacity over the previous decade—its combined cycle and combustion turbine gas additions are larger than its solar and wind additions *combined* (up to 18,400 new gas proposed versus 1,500 MW to 14,000 MW of proposed wind and solar).
2. TVA's capacity planning ranges are of limited use in understanding its planning intentions. There are no prospective schedules for additions or retirements and the planning ranges are too large to draw useful conclusions regarding what would constitute success or failure of the planning exercise.
3. TVA does not publish or provide data on renewable capacity for the years 2011 to 2021 consistently across different data sources including U.S. EIA data, TVA's own publications, and data from the SEC.

V. TVA's 2019 IRP: A Case Study on the Cumberland Retirements

TVA's most recent IRP provides an opportunity for a more detailed assessment of planning methods and a comparison with related planning documents published in or after 2019: Cumberland Fossil Plant Environmental Impact Statement (EIS)—and its related system cost analysis—and a Concentric Energy Advisors review of recent studies critical of TVA planning.[70] A close examination of the Cumberland EIS and the Concentric Report indicates that:

1. The Cumberland EIS utilizes IRP results in a way that leads to incorrect conclusions;
2. TVA's individual resource (or site-specific) assessment methods (as exemplified by the Cumberland EIS) differ significantly in their assessments of viable capacity additions and retirements from the integrated methodology used in the Authority's IRP; and
3. Stakeholder processes make IRPs better, but the TVA process is not currently structured to facilitate effective stakeholder input.

TVA needs a new, up-to-date IRP, with a thorough stakeholder process to include the broadest set of ideas and solutions in an effort to keep ratepayer costs low while meeting TVA's and the nation's climate,

[70] 1) TVA. *2019 Integrated Resource Plan Volume I – Final Resource Plan*. Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/irp/2019-documents/tva-2019-integrated-resource-plan-volume-i-final-resource-plan.pdf?sfvrsn=44251e0a_4; 2) TVA. 2022. *Cumberland Fossil Plant Retirement. Final Environmental Impact Statement.* Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/environment/cumberland-fossil-plant-retirement-final-eis4eeac6f0-b6bf-4843-9881-75d19ccf8ede.pdf?sfvrsn=d61f6b6f_7; 3) Concentric Energy Advisers. 2022. "Assessment of the Draft Environmental Impact Study and Response to Certain Reports." In *Cumberland Fossil Plant Retirement Final Environmental Impact Statement.* Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/environment/cumberland-fossil-plant-retirement-final-eis4eeac6f0-b6bf-4843-9881-75d19ccf8ede.pdf?sfvrsn=d61f6b6f_7

environmental and economic development standards.

The Cumberland 1 and 2 retirements are not modeled in TVA's 2019 IRP.

Since its last IRP in 2019, TVA has put forth other plans that substantively disagree with the IRP's recommended planning ranges. TVA 2019 IRP calls for retirement of the Paradise 3 coal unit (1,150 MW nameplate capacity) in 2020 and Bull Run coal unit (950 MW) in 2023, and plans to "evaluate retirements of up to 2,200 MW of additional coal capacity if cost-effective."[71] TVA's Cumberland Fossil Plant Retirement plan, however, proposes additional coal unit retirements beyond the 2019 IRP plans: retiring an additional 1,300 MW by 2026 and another 1,300 MW by 2028. The Cumberland EIS also recommends a complete retirement of all TVA coal units: 9 units (1,700 MW) at Kingston in 2027, 4 units (1,255 MW) at Gallatin in 2031, and 9 units (1,575 MW) at Shawnee in 2033 (see Figure 8). The latter two retirements represent significant departures from the IRP that impact on major resource decisions not contemplated in the IRP. The additional 2,200 MW of retirements that TVA stated it would evaluate is still less than what is proposed in the Cumberland Fossil Retirement Plan, and also less than the full retirement of all TVA coal units. Cumberland EIS planning circumvents the requirements of the IRP, including stakeholder engagement—indicating that the IRP could have been more aggressive in planning for coal retirements.

Figure 8. TVA coal fleet end-of-life evaluation (retirement dates)

Source: Cumberland EIS Appendix B p.3

TVA incorrectly claims that the Cumberland Unit 1 retirement and replacement (or "Proposed Action Alternatives") is consistent with its IRP:

> *TVA's Proposed Action Alternatives align with the 2019 IRP near-term actions to evaluate engineering end-of-life dates for aging generation units to inform long-term planning and to enhance system flexibility to integrate renewables and distributed resources…The Preferred Alternative replaces coal-fired generation, consistent with the target supply mix adopted in the 2019 IRP and the Coal End-of-Life Evaluation for the aging coal fleet, and meets the purpose and need of the proposed action to have the replacement generation operating by 2026.*[72]

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[71] TVA. *2019 Integrated Resource Plan Volume I – Final Resource Plan*. Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/irp/2019-documents/tva-2019-integrated-resource-plan-volume-i-final-resource-plan.pdf?sfvrsn=44251e0a_4. p.ES-4.

[72] TVA. 2022. *Cumberland Fossil Plant Retirement. Final Environmental Impact Statement.* Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/environment/cumberland-fossil-

> *The decision associated with this EIS is a specific, discrete component of TVA's blended Asset Strategy and consistent with the recommended target power supply mix in the 2019 IRP.*[73]

In fact, none of the 30 scenario-strategy combinations in the IRP anticipate additional coal retirements (beyond Paradise 3 and Bull Run) earlier than 2032 (although the model was permitted to select earlier retirements if found to be cost effective[74]). In contrast, TVA's Cumberland EIS makes a clear and compelling case for accelerating TVA coal plant retirements, citing the age and deterioration of TVA's fleet:

> *Following the completion of the Tennessee Valley Authority (TVA) 2019 Integrated Resource Plan (IRP), TVA began conducting end-of-life evaluations of its operating coalfired generating plants not already scheduled for retirement to inform long-term planning. This evaluation confirmed that the aging TVA coal fleet is among the oldest in the nation and is experiencing deterioration of material condition and performance challenges. The performance challenges are projected to increase because of the coal fleet's advancing age and the difficulty of adapting the fleet's generation within the changing generation profile. The continued long-term operation of some of TVA coal plants, including the Cumberland Fossil Plant (CUF), is contributing to environmental, economic, and reliability risks.*[75]

TVA's 2019 IRP does not anticipate a need to retire aging coal plants and therefore cannot provide a useful reference in making critical resource decisions.

The system planning presented in the 2019 IRP does not anticipate this need. This is a critical planning issue for TVA. An IRP that fails to consider a need to retire old and deteriorating coal plants—some of which are over 60 or more years old—cannot act as a useful reference in TVA's critical resource decisions. New IRP planning is essential given TVA's transformative resource retirement plan presented in the 2022 Cumberland EIS.

It is because of this divergence from TVA's most recent IRP that TVA and Concentric refer to new solar, storage and energy efficiency resources proposed as replacements for Cumberland as "additional" to the amounts already planned in the IRP (and not as part of the IRP's range of planned resource):

plant-retirement-final-eis4eeac6f0-b6bf-4843-9881-75d19ccf8ede.pdf?sfvrsn=d61f6b6f_7. p.iii,v

[73] TVA. 2022. "Appendix B: TVA Alternatives Evaluation." In Cumberland Fossil Plant Retirement: *Final Environmental Impact Statement*. p.22

[74] TVA. *2019 Integrated Resource Plan Volume I – Final Resource Plan*. Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/irp/2019-documents/tva-2019-integrated-resource-plan-volume-i-final-resource-plan.pdf?sfvrsn=44251e0a_4. p.5-7.

[75] TVA. 2022. *Cumberland Fossil Plant Retirement. Final Environmental Impact Statement.* Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/environment/cumberland-fossil-plant-retirement-final-eis4eeac6f0-b6bf-4843-9881-75d19ccf8ede.pdf?sfvrsn=d61f6b6f_7. p.iii

> *Solar additions tied to a replacement of the first CUF unit would need to be in addition to the 10,000 MW already included in TVA's base plans… Analysis indicated a need for 3,000 MW of additional solar to replace the annual energy of the first CUF unit, on top of the 10,000 MW of solar already included in the base plan.*[76]
>
> *The 2019 IRP range includes battery storage up to 2,400 MW by 2028 and up to 5,300 MW by 2038 (depending on technology costs, performance, and load growth). The Grid Strategies report characterizes batteries as a resource akin to a baseload generating resource capable of providing baseload energy and capacity across a majority of hours, while the Synapse report adds 32,000 MW of battery storage plus nearly 30,000 MW of solar in the Solar/Storage Replacement scenario.*[77]
>
> *Moreover, the amount of savings available at those cost levels in TVA's 2019 IRP was constrained to reflect adoption limitations with the underlying delivery strategies and incentive levels. This point was entirely ignored by the Grid Strategies report, which referenced the same source as the Synapse report to support the assertion that more energy efficiency savings were readily available.*[78]

TVA understates the potential for solar and storage resources in its 2019 IRP—to the extent that subsequent reports highlight the need for solar and storage additions well beyond the IRP's highest proposals for the same periods. If Cumberland retirement and replacement was within the (broad) parameters of the IRP, then the new resources proposed in the Cumberland Alternatives would be among the gas, solar and storage additions proposed within the IRP. In addition to -2,800 to 10,900 MW of new gas (combined cycle and combustion turbine) generation by 2028, the TVA 2019 IRP calls for:[79]

- 1,500 to 8,000 MW of new solar by 2028,
- From 0 to 2,400 MW of new storage by 2028, and
- Energy efficiency savings from 0 to 1,800 MW by 2028.

TVA and Concentric describe alternatives proposed to replace Cumberland as "in addition" to those planned amounts. TVA argues that Cumberland 1 can be replaced with 3,000 MW of new solar and 1,700 MW of new batteries[80]; the same amounts would be needed to replace the second unit. (TVA has not

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[76] TVA. 2022. "Appendix B: TVA Alternatives Evaluation." In Cumberland Fossil Plant Retirement: *Final Environmental Impact Statement*. p.13, 14.
[77] TVA. 2022. "Appendix Q – Concentric Report – Response to Synapse and Goggin Reports." In *Final Environmental Impact Statement*. p.12.
[78] Cumberland EIS Appendix Q p.11
[79] TVA. *2019 Integrated Resource Plan Volume I – Final Resource Plan*. Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/irp/2019-documents/tva-2019-integrated-resource-plan-volume-i-final-resource-plan.pdf?sfvrsn=44251e0a_4. p. 9-3 – 9-4.
[80] TVA. 2022. *Cumberland Fossil Plant Retirement. Final Environmental Impact Statement.* Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/environment/cumberland-fossil-plant-retirement-final-eis4eeac6f0-b6bf-4843-9881-75d19ccf8ede.pdf?sfvrsn=d61f6b6f_7. p.53

presented modeling of the replacement of the second unit by any alternative.[81])

Together Cumberland 1 and 2 are 32 percent of TVA's coal capacity and 7 percent of its total capacity: Cumberland's 2026-2028 retirement is not a small change for TVA.[82] This major divergence from TVA's already three-year old 2019 IRP, should have been presented as a new IRP or (equivalently) with full reporting of modeling assumptions, methods, and results, updated to current-year knowledge and expectations, and made fully available for stakeholders and their third-party experts to review. Instead, new IRP-type modeling results that include the unplanned 2023 and 2026 Cumberland retirements were presented in an Appendix to the EIS as a 23-page PowerPoint slide deck, without a full reporting of modeling assumptions, methods, and results.[83]

TVA's modeling assumptions include numerous questionable choices and out-of-date values.

TVA incorrectly assumes that wind generation cannot be part of a viable replacement for Cumberland. The TVA 2019 IRP calls for sunsetting of existing wind contracts and no additional wind investments in the 20-year planning period, outside of an exploration of the sensitivity of modeling results to reductions in TVA's forecasted wind capital costs.[84] Alternatives A, B, and C do not include wind: "Not selected due to low wind speeds in Tennessee Valley and higher transmission costs for out-of-Valley wind, both of which increase relative costs. Wind can provide dependable capacity in both summer and winter, though intermittent."[85]

Concentric's assessment of the draft Cumberland EIS explains that TVA's wind capital cost assumption of $1,807 per kilowatt (kW) is higher than other recent estimates because it includes interconnection costs.[86] NREL's 2022 ATB resource costs, which also include interconnection costs[87], price new wind at $1,462 per

[81] TVA. 2022. *Cumberland Fossil Plant Retirement. Final Environmental Impact Statement.* Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/environment/cumberland-fossil-plant-retirement-final-eis4eeac6f0-b6bf-4843-9881-75d19ccf8ede.pdf?sfvrsn=d61f6b6f_7. p.22; TVA. 2022. "Appendix B: TVA Alternatives Evaluation." In Cumberland Fossil Plant Retirement: *Final Environmental Impact Statement*. p.8

[82] TVA's nameplate coal capacity was 8,080 MW and total generation capacity was 35,866 MW as of 2021 Form EIA-860. Cumberland 1 and 2 are each 1,300 MW.

[83] TVA. 2022. "Appendix B: TVA Alternatives Evaluation." In Cumberland Fossil Plant Retirement: *Final Environmental Impact Statement*.

[84] TVA. *2019 Integrated Resource Plan Volume I – Final Resource Plan*. Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/irp/2019-documents/tva-2019-integrated-resource-plan-volume-i-final-resource-plan.pdf?sfvrsn=44251e0a_4. p.ES-4 and ES-11

[85] TVA. 2022. "Appendix B: TVA Alternatives Evaluation." In Cumberland Fossil Plant Retirement: *Final Environmental Impact Statement*. p.15

[86] TVA. 2022. "Appendix Q – Concentric Report – Response to Synapse and Goggin Reports." In *Final Environmental Impact Statement*. p.8

[87] See https://atb.nrel.gov/electricity/2022/definitions#capex.

kW;[88] Concentric and the TVA 2019 IRP both cite NREL's 2019 ATB costs.[89] NREL's latest wind cost estimates—including interconnection costs—represents a 19 percent decrease from the costs used in TVA modeling. Based on these lower costs, updating assumptions in TVA's modeling has the potential to result in a recommendation for investment in new wind resources.

TVA wrongly assumes that energy efficiency cannot be part of a viable replacement for Cumberland. Alternatives A, B, and C do not include energy efficiency: "Dismissed as EE programs take time to scale and market, while also facing increasing costs for higher depth and penetration levels. EE is well-positioned to help TVA absorb load growth resulting from increased electrification of the economy in the future."[90] Concentric argues that additional energy efficiency savings—beyond the 1,800 MW by 2028 and 2,200 MW by 2038 planned for in TVA's 2019 IRP—are "overly optimistic"[91] Concentric disagrees with alternative modeling showing substantial energy savings at a low cost by 1) rejecting analysis that assumes that upfront efficiency costs can be financed over their lifetime (rather than paid in a lump sum up front), and 2) by criticizing higher cost efficiency investments allocated by other utilities to disadvantaged communities.

U.S. Energy Information Administration (EIA) data (self-reported by utilities) on energy efficiency savings reports 4.0 MW of incremental savings for TVA in 2019, 3.4 MW in 2020 and 1.7 MW in 2021.[92] TVA's slow progress towards meeting its 1,800 MW by 2028 and 2,200 MW by 2038 energy efficiency goals suggest a lot of potential still available for new and low-cost savings measures.

TVA implausibly assumes that demand response cannot be part of a viable replacement for Cumberland. TVA 2019 IRP's range of resource plans includes 0 to 500 MW of demand response (not counting expiring or retiring capacity) by 2028[93] and calls for a "short term action" market potential study for energy efficiency and demand response (which has not yet been completed three years after the publication of the IRP[94]). Cumberland Alternatives A, B, and C do not include demand response: "Dismissed as they are limited in the number of calls available and do not provide reliable firm, dispatchable power. DR can help TVA absorb load growth resulting from increased electrification of the economy and allow TVA to offset

[88] NREL. "2022 Electricity ATB Technologies and Data Overview." Available at: https://atb.nrel.gov/electricity/2022/index.

[89] TVA. 2022. "Appendix Q – Concentric Report – Response to Synapse and Goggin Reports." In *Final Environmental Impact Statement*. p.8

[90] TVA. 2022. "Appendix B: TVA Alternatives Evaluation." In Cumberland Fossil Plant Retirement: *Final Environmental Impact Statement*. p.15

[91] TVA. 2022. "Appendix Q – Concentric Report – Response to Synapse and Goggin Reports." In *Final Environmental Impact Statement*. p. 8-11

[92] U.S. EIA. 2022. *Annual Electric Power Industry Report, Form EIA-861 detailed data files.* Available at: https://www.eia.gov/electricity/data/eia861/.

[93] TVA. *2019 Integrated Resource Plan Volume I – Final Resource Plan*. Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/irp/2019-documents/tva-2019-integrated-resource-plan-volume-i-final-resource-plan.pdf?sfvrsn=44251e0a_4. p.ES-4

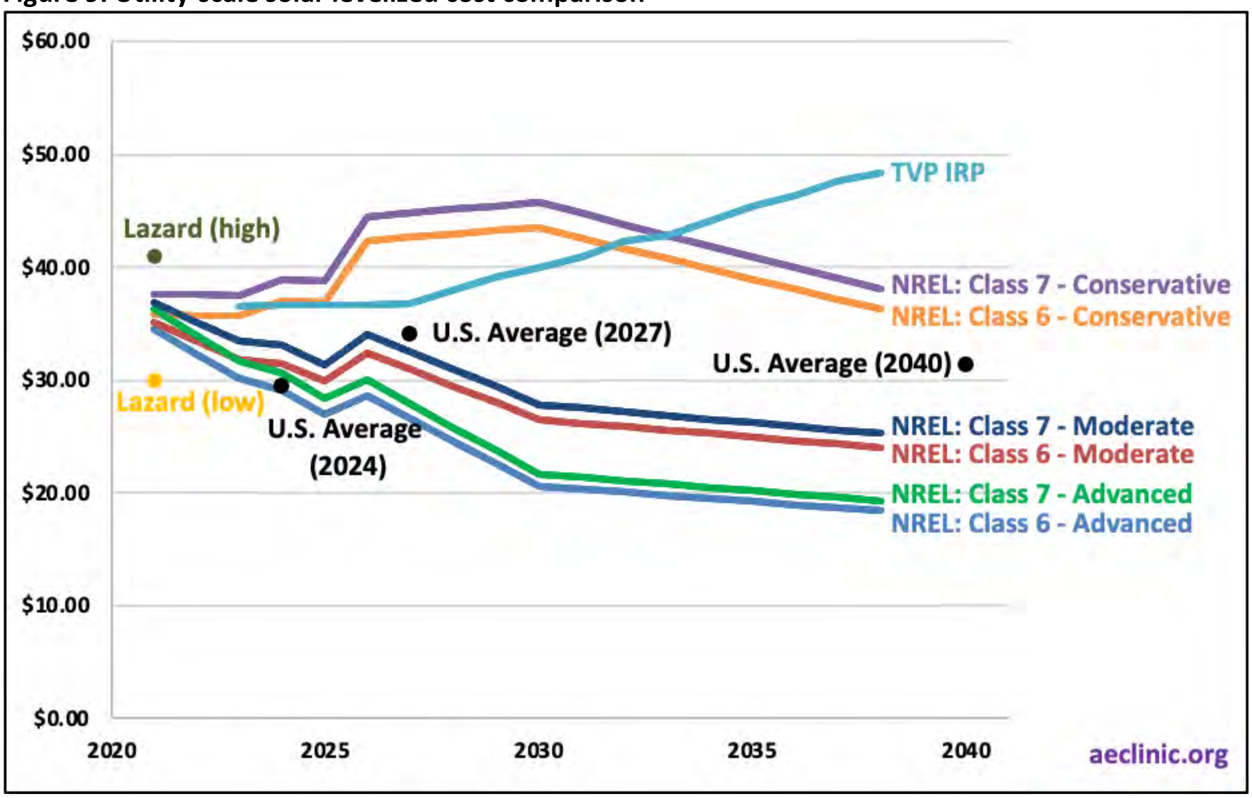
[94] TVA. 2022. "Appendix Q – Concentric Report – Response to Synapse and Goggin Reports." In *Final Environmental Impact Statement*. p.12

physical capacity needs."[95]

TVA improperly finds new gas generation to be more cost effective than renewables. TVA's modeling[96] concludes that system costs with the addition of a 1,450 MW gas combined cycle generator are $1.83 billion (20-year net present value (NPV)) lower than the addition of 3,000 MW solar and 1,700 MW storage—an added cost found by TVA to be 10 times greater than the cost of retirement without replacement. TVA's 20-year NPV system costs in the 2019 IRP range from $100 to 125 billion; but the financial analysis provided with the Cumberland EIS does not report several key data points essential to an effective third-party review: the added system cost of the gas combined cycle Alternative A, assumed gas prices and other commodity prices, and new resource costs.

TVA wrongly assumes that solar cannot be part of a viable replacement for Cumberland. The TVA 2019 IRP assumes solar levelized costs of energy to be $36.49 in 2023 rising to $48.40 in 2038, values that are substantially higher than other industry projections, particular in later years when TVA's solar cost assumptions exceed all common industry estimates (see Figure 9).

Figure 9. Utility-scale solar levelized cost comparison



Note. Class 6 and 7 resources refer to the NREL Annual Technology Baseline's solar resource classes, which vary based on the

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[95] TVA. 2022. "Appendix B: TVA Alternatives Evaluation." In Cumberland Fossil Plant Retirement: *Final Environmental Impact Statement*. p.15

[96] TVA. 2022. *Cumberland Fossil Plant Retirement. Final Environmental Impact Statement.* Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/environment/cumberland-fossil-plant-retirement-final-eis4eeac6f0-b6bf-4843-9881-75d19ccf8ede.pdf?sfvrsn=d61f6b6f_7. p. 80.

irradiance of the solar resource. Class 6 resources experience global horizontal irradiance of between 4.5 – 4.75 kWh/m²/day. Class 7 resources experience 4.25 – 4.5 kWh/m²/day.
Source: 1) TVA. 2019.TVA 2019 IRP. Figure 8-14 Wind and Solar Cost Comparison. p.8-14. Data extracted with WebPlotDigitizer; 2) LAZARD. 2021. Levelized Cost of Energy Analysis – Version 15.0. Available at: https://www.lazard.com/media/451881/lazards-levelized-cost-of-energy-version-150-vf.pdf. p. 2; 3) NREL. 2022. Annual Technology Baseline (ATB). Available at: https://atb.nrel.gov/electricity/2022/data; 4) NREL. "Utility-Scale PV." Available at: https://atb.nrel.gov/electricity/2022/utility-scale_pv; 5) U.S. EIA. 2022. "Levelized Costs of New Generation Resources in the Annual Energy Outlook 2022." Available at: https://www.eia.gov/outlooks/aeo/pdf/electricity_generation.pdf. p. 4.

U.S. EIA data report no growth in Tennessee utility-owned solar generation in 2019, 2020, or 2021 (solar capacity remained constant at 1.6 MW, with ownership by Nashville Electric Service). Total utility-scale solar located in Tennessee rose from 181 MW in 2018 up to 194 MW in 2021, none of which reported TVA ownership.[97] TVA has sharply increased its purchased solar power since 2018, indicating that it has much more room to add solar within its 2019 planning ranges. TVA added 425.7 MW of solar—entirely through power purchase contracts—between 2018 and 2022.[98] The TVA 2019 IRP proposes 1,500 to 8,000 MW of solar additions by 2028 and up to 14,000 MW by 2038.[99]

TVA without adequate evidence assumes that storage cannot be part of a viable replacement for Cumberland. TVA's assumed battery storage costs rely on its in-house estimation of uncertainty in future battery operation and on the assumption that existing battery cost projections are vulnerable to unexpected increases in fixed operations and maintenance. While it may be that this impactful choice can be substantiated, TVA has not provided sufficient evidence to demonstrate the reasonableness of the assumption.

It is also important to note that TVA's IRP and the Cumberland EIS plan take only 4-hour batteries into consideration, excluding the 8-hour and 10-hour batteries that are expected to form part of a needed suite of flexible, dispatchable peak resources within TVA's planning period. For instance, C Power procured two 8-hour lithium-ion battery systems in early 2022 to provide peak energy in California.[100]

The TVA 2019 IRP plans for 2,400 MW battery storage by 2028 and up to 5,300 MW by 2038.[101] Concentric compares additional storage in the Cumberland Alternative C to U.S. current-day installed battery resources:

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97 U.S. EIA. 2022. *Annual Electric Power Industry Report, Form EIA-861 detailed data files.* Available at: https://www.eia.gov/electricity/data/eia861/.

98 *SELC calculations using: TVA. "SEC Filings." Available at: https://tva.q4ir.com/financial-information/sec-filings/default.aspx*.

99 TVA. *2019 Integrated Resource Plan Volume I – Final Resource Plan*. Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/irp/2019-documents/tva-2019-integrated-resource-plan-volume-i-final-resource-plan.pdf?sfvrsn=44251e0a_4. p.ES-4

100 Colthorpe, Andy. March 8, 2022. "Second eight-hour lithium-ion battery system picked in California long-duration storage procurement." *Energy Storage News.* Available at: https://www.energy-storage.news/second-eight-hour-lithium-ion-battery-system-picked-in-california-long-duration-storage-procurement/

101 TVA. *2019 Integrated Resource Plan Volume I – Final Resource Plan*. Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/irp/2019-documents/tva-2019-integrated-resource-plan-volume-i-final-resource-plan.pdf?sfvrsn=44251e0a_4. p.ES-4

> *In 2019, the U.S. Energy Information Administration indicated there was a total combined battery storage capacity of about 1,000 MW which grew to 1,500 in 2020 and then to over 4,500 in 2021. As part of Alternative C, adding 1,700 MW of storage by 2026 for the CUF retirement would result in TVA adding, owning, and operating more battery storage capacity over the next 4 years than the entire United States had in 2020. (Cumberland EIS Appendix Q p.15)*

This comparison of planned U.S. storage capacity in 2026 to existing capacity in 2021 muddies an important concern in electric resource planning and obscures the real potential to deploy cost effective peaking resources to TVA customers' benefit. Far from the 4,500 MW battery storage in operation in the United States in 2021, U.S. EIA's 2022 expectation for 2025 battery storage capacity is 30,000 MW;[102] a recent Bloomberg energy news report forecasts U.S. battery capacity of 50,000 MW in 2025 and 110,000 MW in 2030.[103] An additional 1,700 MW of storage as proposed in Alternative C would be an important part of that U.S. total, but it would in no way dwarf nationwide storage capacity as suggested by Concentric.

TVA's Cumberland replacement cost comparison appears to omit carbon prices. The TVA 2019 IRP assumes a $0 carbon price in its Current Outlook, Economic Downturn, Rapid DER Adoption and No Nuclear Extension future scenarios; an approximately $5 per ton in 2025 rising to $7 per ton in 2038 carbon price in the Valley Load Growth scenario; and an approximately $20 per ton in 2025 rising to $40 per ton in 2038 carbon price in the Decarbonization scenario.[104] (The IRP also explores a "double decarbonization" modeling sensitivity with carbon prices of $40 per ton in 2025 rising to $80 per ton in 2038.[105]) TVA does not reveal its policy assumptions used in developing the trajectories of these carbon prices nor does it explain why the prices vary the way they do in different scenarios. The addition of carbon prices in IRP modeling further improves the cost effectiveness of resource portfolios with greater shares of renewables, storage, energy efficiency and demand response and increases the investments in these zero-carbon resources recommended by optimization modeling. New Inflation Reduction Act funding, not modeled by TVA, would have a similar effect of making many zero-carbon resources more cost effective.

The Cumberland Retirement EIS's Final Alternatives Evaluation omits any mention of a carbon price and, indeed, any mention of the future scenario assumptions under which its Cumberland replacement cost analysis was conducted. The 1,450 MW gas combined cycle power plant proposed as Alternative A would generate 7 TWh per year, assuming the same 55 percent capacity factor used in the Cumberland EIS

[102] U.S. Energy Information Administration. December 8, 2022. "U.S. battery storage capacity will increase significantly by 2025". Available at: https://www.eia.gov/todayinenergy/detail.php?id=54939#:~:text=As%20of%20October%202022%2C%207.8,GW%20of%20battery%20storage%20capacity

[103] Henze, V. October 12, 2022. "Global Energy Storage Market to Grow 15-Fold by 2030". BloombergNEF. Available at: https://about.bnef.com/blog/global-energy-storage-market-to-grow-15-fold-by-2030/

[104] TVA. *2019 Integrated Resource Plan Volume I – Final Resource Plan*. Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/irp/2019-documents/tva-2019-integrated-resource-plan-volume-i-final-resource-plan.pdf?sfvrsn=44251e0a_4. p.6-6

[105] Ibid, IRP p.8-17

assessment of social costs.[106] Over a 20-year planning period, a rough approximation of the additional costs associated with carbon prices in Alternative A would be $840 million in the Valley Load Growth scenario, $4.2 billion in the Decarbonization scenario, and $8.4 billion using the double decarbonization carbon price before levelization.

TVA-sponsored analysis suggests spurious limitations to TVA renewable resource investment. Concentric's October 2022 report prepared for TVA as an assessment of its draft Cumberland EIS erroneously suggests that the results of MISO's 2021 Renewable Integration Impact Assessment are a limiting factor in TVA's short- and medium-term renewables additions:

> *Due to environmental mandates requiring "clean" generating resources by a certain date, and the uncertainty around the impact of a high penetration of zero-emitting generating resources on the power system, system operators have conducted highly detailed studies to explore how wind and solar growth would affect reliability and resiliency. These studies…have shown that the complexity of renewable integration escalates with the growing penetration of renewable energy, requiring significant physical and operational changes to the bulk power system. Over some renewable penetration ranges, complexity is constant when spare capacity and flexibility exist. However, at specific penetration levels, complexity rises dramatically as the excess capacity and flexibility are exhausted. These represent system inflection points, where the underlying infrastructure, system operations, or both need to be significantly modified to reliably achieve the next tranche of renewable deployment. (Cumberland EIS Appendix Q p.18)*

MISO's analysis finds that challenges to system integration begin when wind and solar levels exceed 30 percent of total system capacity and that, importantly, these challenges occur in the absence of RTO-wide investments in transmission and other integration upgrades. Concentric fails to mention that no IRP scenario-strategy combination exceeds 8 percent wind and solar by 2028 or 17 percent by 2038 on the TVA system. Adding solar proposed as Cumberland Alternative C raises the renewable share to 17 percent in 2028 and 26 percent in 2038 on the TVA system. Integration challenges posed by MISO reaching 30 percent wind and solar are not expected to occur in the TVA region in the next 20 years.

TVA finds Alternative C solar plus storage construction to be too long and too complex as compared to the Alternative A gas combined cycle generator. TVA anticipates the need for "Construction and operation of many (likely 20+) solar and storage facilities"[107] and finds that the Alternative C "Solar & storage and transmission projects fail to meet 2026 timeline by 3+ years and higher costs for reliability and environmental compliance at [Cumberland]."[108] Concentric refers to Alternative C as "orchestrating a symphony of assumed capabilities and costs of energy efficiency, solar, wind, and batteries along with the accompanying transmission upgrades" and concludes that it is "simply not a viable or rigorous approach as

[106] TVA. 2022. *Cumberland Fossil Plant Retirement. Final Environmental Impact Statement.* Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/environment/cumberland-fossil-plant-retirement-final-eis4eeac6f0-b6bf-4843-9881-75d19ccf8ede.pdf?sfvrsn=d61f6b6f_7. p.273
[107] TVA. 2022. "Appendix B: TVA Alternatives Evaluation." In Cumberland Fossil Plant Retirement: *Final Environmental Impact Statement*. p.12
[108] Ibid, p.18.

a near-term alternative that meets system reliability requirements."[109]

International Energy Agency data for electric construction projects for 2010 to 2018 show renewable power completed 1.5 to 2 years more quickly than fossil-fuel resources.[110] In addition, if more time were needed to build a desired alternative, TVA's EIS reports that Cumberland retirement is not required until 2028[111] and that TVA could itself construct utility-scale solar rather than relying on the quick deployment of a large number of smaller third-party solar farms.[112] The issuance of an all-source or solar-specific request for proposals (RFP) in advance of performing both the 2019 IRP and the Cumberland EIS would have allowed for more accurate, market-based assumptions regarding both solar availability and solar costs.

If the Cumberland brownfield were converted to solar panels—an option not presented by TVA—its 2,388 acres (less 326 acres of coal ash pits[113]) would accommodate 900 MW of solar—30 percent of the total amount proposed in Alternative C.[114] TVA also omits the consideration of solar panels added to its Johnsonville and Gleason sites, proposed to accommodate additional gas combustion turbines under Alternative B.

TVA could increase the accuracy and relevancy of its planning by issuing an all-source RFP and using the resulting bids to set resource prices in modeling.

TVA's IRP-type analysis of the 2026 Cumberland coal unit retirement, not anticipated in the 2019 IRP, has only been made available to stakeholders in the form of a brief summary of modeling results, without the benefit of stakeholder input or detailed information regarding modeling scenarios, commodity and resources costs, carbon prices, and other key modeling inputs. The 2022 Cumberland analysis appears to share an additional serious flaw with the TVA 2019 IRP: Neither cost assessment draws real-world, real-time resource prices from an all-source RFP specific to the TVA context. The practice of issuing an all-source RFP in advance of IRP and other similar planning exercises (see for example the NIPSCO 2019 and 2021 IRPs)[115] has important advantages for increasing the accuracy and relevancy of planning and the potential to aid in reducing system costs for ratepayers.

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[109] TVA. 2022. "Appendix Q – Concentric Report – Response to Synapse and Goggin Reports." In *Final Environmental Impact Statement*. p.2

[110] International Energy Agency. October 26, 2022. "Average power generation construction time (capacity weighted), 2010-2018." *IEA.* Available at: https://www.iea.org/data-and-statistics/charts/average-power-generation-construction-time-capacity-weighted-2010-2018.

[111] TVA. 2022. "Appendix B: TVA Alternatives Evaluation." In Cumberland Fossil Plant Retirement: *Final Environmental Impact Statement*. p.3

[112] Ibid, p.12

[113] TVA. 2022. *Cumberland Fossil Plant Retirement. Final Environmental Impact Statement.* Available at: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/environment/cumberland-fossil-plant-retirement-final-eis4eeac6f0-b6bf-4843-9881-75d19ccf8ede.pdf?sfvrsn=d61f6b6f_7. p.10

[114] Based on a rule of thumb approximation of 1 kW of solar per 100 square feet.

[115] 1) NIPSCO. 2021. *Northern Indiana Public Service Company LLC 2021 Integrated Resource Plan.* Available at: https://www.nipsco.com/docs/librariesprovider11/rates-and-tariffs/irp/2021-nipsco-integrated-resource-plan.pdf; 2) NIPSCO 2018. *Northern Indiana Public Service Company LLC Integrated Resource Plan.* Available at: https://www.nipsco.com/docs/librariesprovider11/rates-and-tariffs/irp/2018-nipsco-irp.pdf?sfvrsn=83256851_16.

An all-source RFP solicits resources that could be constructed or otherwise made available today under current market expectations of near-time future pricing with an open-bidding process for any interested parties. The results of all-source RFPs should be compared and incorporated together with price forecasts from reputable sources.

Resource prices developed in this way have the greatest likelihood of conforming to market expectations regarding both cost and actual availability. Power purchase agreement prices have risen recently due to short-term supply chain issues and the rise in interconnection costs, but TVA should not face the latter issue and should not let higher prices prevent it from soliciting responses. TVA's IRP and Cumberland retirement analyses also lack (or fail to report) any resource portfolios developed through unconstrained optimization. TVA's IRP modeling includes 30 constrained optimization runs of scenario-strategy pairings, and several related sensitivity runs, but fails to explore a portfolio developed through model optimization in the context of any and all resources being made available for model selection. Unconstrained optimization is an important tool available to utility planners in IRP and other similar resource planning exercises that permits the development of new resource combinations without an intervening filter of modeler selection.

VI. Recommendations

TVA is planning to produce a new IRP by late 2024. Two major changes have occurred since the 2019 IRP that are essential to reflect in any new planning process. First, TVA has committed to a climate goal of net zero greenhouse gas emissions by 2050, with an 80 percent carbon reduction by 2035 and a 70 percent carbon reduction by 2030. TVA is also subject to the Paris Agreement's commitment to help limit temperature increases from pre-industrial levels and to the Biden-Harris Administration's executive orders calling for carbon-free electricity by 2035. Second, Congress passed the Inflation Reduction Act, and it was signed into law by President Biden. The bill dramatically expanded numerous tax credits, grants, and other subsidization schemes for zero emission energy and storage resources. The following recommendations for TVA's planning process in that IRP and for subsequent site-specific planning exercises are based on these key developments together with the assessments of TVA's IRPs and site-specific planning methods:

- **TVA must incorporate its own net zero by 2050 commitment as well as the 2035 federal decarbonization goal as clear policy goals and basic modeling limitations in its IRP and craft plans in which all portfolios achieve these goals.** TVA's 2019 IRP is rendered defunct by the release of TVA's own emissions targets and federal climate goals. TVA should be transparent both about its scheduled capacity additions and retirements, and about which resources will supply the necessary emission reductions to meet its own climate goals, those of the Paris Agreement, and the instruction to federal agencies to pursue a goal of carbon-free electricity by 2035.
- **TVA must be more transparent regarding its assumptions and modeling inputs**, including its assumed carbon price and social costs of further investments in emitting resources—preferably making a detailed technical appendix available for public review.
- **TVA's IRPs need a clear selection of a portfolio with a more targeted preferred resource plan**.

The selected portfolio should provide schedules for prospective additions and retirements of coal and gas plants as well as the for the addition of zero emission sources of power. Absent these detailed expectations, planning ranges alone do not permit either TVA or other stakeholders to assess the impacts of the most likely resource additions or effectively evaluate the environmental or economic benefits of prior capacity additions.

- **TVA should state clearly how it intends to utilize the grants, loans, and tax credits of the of the Inflation Reduction Act**. One example provision is direct pay of IRA tax credits; this provision explicitly state that TVA can access credit money for eligible projects through direct payments from the U.S. Treasury. TVA needs to document how IRA programs affect its modeling, selected resource plans, and finances.
- **TVA must clarify how it demarcates "ownership" of solar and wind resources between its distribution utilities, power purchase agreements from other parties, and capacity that TVA outright owns.** Currently, TVA does not specify why its claimed solar and wind resources are not reported in EIA data, nor the extent to which its renewable resources are capacity owned and operated by its distribution utility partners or capacity it has access to through power purchase agreements. TVA should also be transparent about the renewable attributes committed to third parties through renewable energy credits.
- **TVA should provide reliable annual or monthly data on solar, wind, and storage capacity**. These time-series data should also distinguish between utility-scale resources that represent TVA's own capacity, contracted capacity, and/or capacity from TVA's distribution utility or municipal partners that TVA claims as its own. The data are essential to an effective evaluation of TVA's past and future plans by making a comparison between proposed and actual renewable additions.
- **TVA should conduct an all-resource RFP of resources that could be made available today under current market prices.** Resource cost assumptions made in the absence of an all-resource RFP provide inferior information that biases modeling results, and compare and include price forecasts from reputable sources.
- **TVA must ensure that its site-specific planning documents, such as environmental impact statements, reflect the most recent IRPs plans and use methods that do not result in contradictions between overall-system- and site-specific planning exercises.** Site-specific planning exercises should also provide detailed technical appendixes with information on modeling inputs and outputs. Site-specific planning exercises should state clearly how their proposed capacity additions (and assessments of the viability or infeasibility of alternative additions) integrate with or alter the findings of the most recent IRP.

From:	Rachael Maitland
To:	Integrated Resource Plan
Cc:	
Subject:	TDEC Comments: 2024 IRP Notice of Intent
Date:	Monday, July 3, 2023 4:15:31 PM
Attachments:	image001.png TDEC Comment - 2024 IRP and EIS.pdf

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Ms. Baxter,

Please see the attached letter which includes comments from TDEC on the 2024 IRP and associated EIS. Thank you for the opportunity to provide comment on the topics and issues to be addressed by TVA in this important update. We look forward to future opportunities to receive updates on this plan.

Best,

Rachael

TN Department of Environment & Conservation

Rachael Maitland | Senior Policy Analyst

Office of Policy & Planning

Tennessee Tower, Second Floor

312 Rosa L. Parks Ave., Nashville, TN 37243

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STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
NASHVILLE, TENNESSEE 37243-0435

DAVID W. SALYERS, P.E.
COMMISSIONER

BILL LEE
GOVERNOR

July 3, 2023

<u>Via Electronic Mail to IRP@tva.gov</u>
Tennessee Valley Authority
Kelly Baxter, NEPA Specialist
400 West Summit Hill Drive, WT 11B
Knoxville, TN 37901

RE: TVA Notice of Intent Integrated Resource Plan and Environmental Impact Statement

Dear Ms. Baxter,

The Tennessee Department of Environment and Conservation (TDEC) appreciates the opportunity to provide comments on the Tennessee Valley Authority (TVA) Notice of Intent (NOI) to update and replace its 2019 Integrated Resource Plan (IRP) and associated Supplemental Environmental Impact Statement (EIS). The updated IRP serves as a guide for how the agency can best meet energy demand in the coming decades, taking into consideration TVA's resource needs, policy goals, physical and operational constraints, risks, and proposed resource choices. As part of the study, TVA will prepare an environmental impact statement (EIS) to analyze the potential environmental impacts associated with the IRP. TVA will use the IRP and EIS development processes to elicit and prioritize the values and concerns of stakeholders; identify issues, trends, events, and tradeoffs affecting TVA's policies; formulate, evaluate and compare alternative portfolios of energy resource options; provide opportunities for public review and comment; and ensure that TVA's evaluation of alternative energy resource strategies reflects a full range of stakeholder input.

TDEC has reviewed the NOI and has the following comments regarding the proposed IRP and EIS.

General Comments

- TDEC commends TVA for seeking input from the public and stakeholders in the development of the IRP. TDEC is currently represented on both of TVA's public advisory councils, the Regional Energy Resource Council (RERC) and the Regional Resource Stewardship Council (RRSC). TDEC encourages TVA to utilize the expertise of these councils to seek input in the development and associated actions outlined in the IRP.
- TVA asked for comments about how to effectively reach and receive comments from environmental justice communities. TDEC encourages TVA to address the federal Justice40 initiative in the IRP, including guidelines for how TVA will ensure that investments benefit disadvantaged communities. Furthermore, TDEC suggests the following to effectively reach communities with environmental justice concerns:
    - Identify Communities: In planning for the IRP and EIS, TVA should understand the communities that are most impacted by TVA operations. TDEC encourages TVA to utilize federal mapping tools to identify disadvantaged communities, tribal land, and other communities with

    environmental justice concerns, including the Climate and Economic Justice Screening Tool (CEJST) and EPA's EJScreen. TDEC further encourages TVA to further integrate other data that may support identification of overburdened or disadvantaged communities, such as energy burden and vulnerability to extreme weather events.
    - Coordinate with Community Groups: TDEC encourages TVA to partner with community organizations in the development of the IRP to reach traditionally underserved communities. Community groups and leaders should be well represented in stakeholder and public engagement and the comments received from these groups should be given full consideration in the development of the plan.
    - Focus on Early Coordination: TVA should begin outreaching to overburdened or disadvantaged communities as early as possible in the development of the IRP. Early and frequent engagement and opportunities to provide feedback to TVA will benefit the process.
- TDEC encourages TVA to consider Tennessee and the Tennessee Valley's rural communities in the development of the IRP and EIS, specifically regarding:
    - Environmental Impact: As TVA reviews environmental issues in the IRP EIS, TDEC encourages TVA to recognize how issues such as water quality, air quality, waste generation and disposal, land use, and socioeconomic impacts may differ in rural areas. This may involve thinking beyond the proposed regional assessment to identify local hotspots and other environmental and economic considerations.
    - Workforce and Economic Development: The closing or transition of existing coal fired plants can disproportionately impact rural economies. In the utilization of a scenario planning approach, we encourage TVA to consider the impact on rural communities in different conditions over the planning horizon. To the extent possible, TVA should work directly in the community and with community groups to support these economies and prioritize workforce and economic development opportunities.
- TDEC encourages TVA to align the IRP with federal policies, programs, and investments. Specifically, the Bipartisan Infrastructure Law and Inflation Reduction Act make considerable investments in infrastructure and clean energy projects. TVA should continue to seek out opportunities to advance the use of clean energy to meet future energy demand.

Water Resources

- TDEC notes that the retirement of coal fired plants and emphasis on solar, nuclear and natural gas fired plants may reduce the need for water withdrawal and discharge permits that were necessary for cooling and other high-water use for the coal fired plants. The change in resource use could be significantly beneficial for the waters of the state. TDEC recommends that TVA fully consider the potential benefits to state waters when developing strategies for energy portfolios and continue to work closely with both the RERC and RRSC to explore the nexus of water and energy across the Valley with the shift in the energy portfolio.
- TVA must consider the potential impacts of their water withdrawals on public water systems and water resources across the state. Through American Rescue Plan funding, TDEC has provided grants to Tennessee communities to make needed updates to water, wastewater, and stormwater infrastructure. TDEC encourages TVA to work directly with communities and local providers to ensure that future resource planning is consistent with local infrastructure capacity. Furthermore, the Tennessee Safe Drinking Water Act and associated rules (Rule 0400-45-01-.34) requires entities contemplating water withdrawals to consider the impact on existing public water supply sources.

Energy

- TDEC recommends that TVA continue to consider how energy use will change in the TVA service area over the next 20 years and include those considerations in the 2024 IRP and EIS, specifically with respect to increased electrification and improvements in energy storage.
- TDEC recommends that TVA consider its current fuel mix and whether it should be further diversified, and if so, in what manner, and include these considerations in the 2024 IRP and EIS. Specifically:
    - Coal and Natural Gas: TDEC supports TVA's efforts to transition TVA's coal-fired plants and recognizes TVA's plans to replace this capacity with natural gas-fueled combustion turbines. TDEC encourages TVA to consider the potential GHG and other air pollutants of this transition, particularly the release of methane in power generation and during the supply chain. We also encourage TVA to continue to explore renewable alternatives and clean energy technology at these sites, including hydrogen fuel and carbon capture technology.
    - Hydropower: Upgrades to existing hydropower facilities could result in additional generation capacity which could replace older, less efficient generation assets.
    - Nuclear: TDEC encourages TVA to address the role that nuclear energy will plan in the energy transition of the Tennessee Valley. Tennessee is poised to be a national leader in nuclear energy, and TVA has the opportunity to lead nuclear innovation and investment. TVA should integrate the work of the newly announced Tennessee Nuclear Energy Advisory Council and any associated opportunities to support nuclear energy build-out in the state into the 2024 IRP.
    - Solar: Large scale, dispatchable solar generation (solar plus storage) will likely become a cost-competitive resource in the next 10 years as battery and solar technology continue to improve while their costs continue to fall. TVA should also consider the role of, and any programs or incentives required to support, distributed solar in urban environments or opportunities to leverage solar on brownfields or former landfills as part of the broader energy portfolio.
    - Other Renewables: TDEC supports efforts to increase energy resiliency in the state, including the use of mixed energy sources including renewables. These additional sources can be used in the event of an emergency or increased energy demand. TVA should consider development of additional utility-scale renewable energy projects. Increasingly, having significant amounts of renewable power available for purchase is a necessary requirement for green field development projects for data centers, progressive manufacturing plants, and large retail chains. These types of projects are critical economic development tools that could support TVA and its Local Power Companies' (LPCs) needs to remain relevant and competitive with regard to the recruitment, retention, and expansion of businesses and industries throughout the Tennessee Valley.

Cultural and Natural Resources

- TDEC encourages TVA to consider the impact that future resource planning and use has on cultural and natural resources in the Tennessee Valley. As TVA plans for future plant retirements and change in land use, it is vital to consider the impact of land use change on biodiversity, archeological resources, and other natural resources. TDEC encourages TVA to address how they will incorporate responsible environmental stewardship in the management of TVA land and resources.

TDEC appreciates the opportunity to provide comment on the topics and issues to be addressed in TVA's 2024 IRP and EIS. TDEC looks forward to further opportunities to support the development of the IRP and EIS, including involvement on the working group and providing comments on future draft documents. Please note that these comments are not indicative of approval or disapproval of the proposed content or updates to the 2019 TVA IRP and EIS. Please contact me should you have any questions regarding these comments.

Sincerely,

R. Maitland

Rachael Maitland, Senior Policy Analyst
Office of Policy and Planning
Tennessee Department of Environment and Conservation
rachael.maitland@tn.gov

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#30]
Date:	Monday, July 3, 2023 4:40:47 PM

Name	Maggie Shober
City	Knoxville
State	TN
Organization	Southern Alliance for Clean Energy
Email	
Phone Number	
Please provide your comments by uploading a file or by entering them below. *	Please see attached file for SACE's comments on the scope of the 2024 IRP.
Upload File #1	tva_2024_irp__sace_scoping_comments.pdf 170.32 KB · PDF

Kelly Baxter
NEPA Project Manager
400 W. Summit Hill Drive, WT 11B
Knoxville, Tennessee 37902

Re: Comments on Scoping of TVA's 2024 Integrated Resource Plan

Dear Ms. Baxter:

Electric utility resource planning has an even more important role as the electric sector transitions to new types of generating resources, as demand-side technologies and programs become increasingly flexible and connected, as energy-related policies shift at the national, state, and local levels, and as the aging grid is tested by increasingly frequent and extreme weather. TVA's 2024 Integrated Resource Plan (IRP) will serve the Tennessee Valley region at this critical juncture. If the 2024 IRP does not steer TVA's future resource mix in a way that will reliably decarbonize and protect ratepayers, it will be a huge missed opportunity and the people of the Tennessee Valley will be the ones that suffer the consequences: higher and higher electric bills for less and less reliable service. As respected resource and planning experts across the region with decades of experience, SACE submits a list of recommendations for both the process and the method of TVA's 2024 IRP through this scoping comment period. We are happy to meet with TVA staff throughout the IRP process to provide further guidance or clarification about the recommendations made here, and any other aspects of the 2024 IRP.

SACE Recommendations for 2024 IRP Process

1. In past IRPs, TVA has utilized an IRP Working Group as its primary stakeholder process to guide the IRP method, scenarios, inputs, metrics, and more. However, the working group is invite-only, meetings are not open to the public, and do not facilitate input from stakeholders that are not a part of the working group. Therefore, we recommend that TVA make its IRP working group meetings open to the public, both in-person and live-streamed online. We also recommend that TVA post agendas and materials for each meeting a week in advance, videos of each meeting 24 hours after its conclusion, and a summary of the meeting within a week of its conclusion. Since past working group members have had to sign a confidentiality agreement, this setup would allow equitable sharing of resources from TVA on its ongoing IRP work without working group members worrying about what is free to share and what isn't. In the event that a meeting has discussions of confidential information, those portions of the meeting would not be streamed or shared, much like Public Service Commissions (PSCs) that do certain business in executive session. However, to make use of these meetings, we recommend that TVA keep to a minimum its claims that information shared in these meetings is confidential.
2. Once a draft IRP is developed and published, it is very difficult to make major or even moderate changes. That is why input from a variety of stakeholders, not just those on the working group, throughout the development of the draft IRP is so important. Therefore, in addition to the opening of working group meetings described in SACE Process Comment #1 above, we recommend that TVA set up a way for stakeholders to submit comments and information requests from the time the scoping report is published through the publication of the draft IRP. A key part of this process

is a transparent and regular way for TVA to respond to these requests and comments in a timely manner. This could be modeled after the discovery process that occurs during IRP and other proceedings within PSC dockets. The utility usually has a set amount of time to respond, for instance in Indiana the response time is 15 business days. We recommend that TVA adopt this timeframe, and set up a portal for stakeholders to submit comments and requests, and that all of TVA's responses be posted in that same portal within 15 business days.

3. The TVA Board of Directors has ultimate responsibility for approving TVA's 2024 IRP. Thus we recommend that TVA set up a hearing or similar proceeding for TVA's Board of Directors to hear directly from stakeholders, regardless of whether or not they participated in the IRP working group or one of TVA's other invite-only stakeholder groups. The best time for this to occur is likely after the Draft IRP comment period closes but well before TVA publishes a final IRP and presents it to its Board. That way the Board can provide direction to TVA on what, if any, changes or additions it wants TVA to make to its final IRP based on evidence presented by stakeholders. SACE has extensive experience participating in these kinds of hearings in other state-regulated jurisdictions, and can help TVA design a format that would allow for efficiency, transparency, and most importantly the ability for members of the Board to hear directly from stakeholders and independent experts on important topics.

SACE Recommendations for 2024 IRP Method

1. The 2024 IRP should include transparent, comprehensive, and proactive transmission planning.
    - TVA has cited long lead times for transmission work to add solar and storage as a key barrier to getting these resources on the grid quickly and at scale. Yet TVA has not announced any proactive measures it is taking to plan and upgrade its transmission system to be able to handle the level of distributed and variable resources needed to decarbonize its grid. The 2024 IRP is a critical time for TVA to include transparent transmission planning that targets sections of its grid that have known current or future constraints and/or are attractive areas for renewable or storage resources. This process can include hosting capacity mapping for solar, storage, and electric vehicle charging, but should go far beyond that. In 2005 the Texas legislature identified the potential role wind energy could play in its state, and passed legislation directing its grid operator to identify high wind potential areas that were not well connected to its grid and build transmission projects to those areas, called the Competitive Renewable Energy Zones (CREZ). The CREZ transmission investments of $6.8 billion have resulted in more benefits than originally anticipated: production cost savings of $1.7 billion per year and $5 billion in incremental economic development.[1]
    - TVA does not experience all the same barriers to transmission development that state-regulated utilities experience, namely requiring approval of state commissions. Therefore, it is critical that TVA take the opportunity to integrate proactive transmission planning into its 2024 IRP. A look next door at Duke's North Carolina Carbon Plan process shows the difficulties in generation and transmission planning through siloed and disjointed processes. If TVA combines proactive transmission planning into this IRP, and hopefully future IRPs, it can more efficiently address what is likely the biggest barrier to decarbonizing the grid. To do this in the 2024 IRP, it may be best for TVA to convene a separate stakeholder or working group to focus exclusively on transmission issues.

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[1] For more on CREZ as a model, see the resources available from transmission experts at Americans for a Clean Energy Grid here: https://cleanenergygrid.org/texas-national-model-bringing-clean-energy-grid/.

2. The 2024 IRP should include forward-looking energy efficiency and demand-side management programs and technologies.
    - Technologies like heat pumps have come a long way even since TVA's 2019 IRP, for instance their ability to operate efficiently at much lower temperatures. Technologies are also becoming more connected, allowing for the development of innovative demand response and virtual power plant programs. TVA has historically modeled energy efficiency resources alongside supply resources in its IRP, and we recommend that TVA continue to do so in the 2024 IRP, but with a much higher level or granularity than was done in the 2019 IRP. The Northwest Power and Conservation Council (NPCC), that performs resource planning for a four-state region in the northwest that includes the Bonneville Power Administration (BPA), continues to be a model for modeling energy efficiency as a resource in resource planning. More information, including all assumption spreadsheets, on the NPCC's latest power plan are available through their portal here: https://www.nwcouncil.org/2021-northwest-power-plan/. One member of SACE staff helped to develop the methods and models used in the previous power plan, and is available to assist TVA staff in including some of these methods and models in its 2024 IRP.
    - Even if TVA does not fully adopt the NPCC's EE as a resource method, it is imperative that TVA include reasonable cost assumptions for the implementation of energy efficiency programs, specific load profiles for specific measures to capture the benefits of programs to shave either winter or summer peaks, and that TVA make the size of available blocks of energy efficiency savings small enough that the model can ramp up programs in a way similar to how energy efficiency programs can be ramped up and down.
3. The 2024 IRP should include distributed energy resources at all levels, including programs to encourage residential and small business customers to adopt solar, storage, and smart technologies.
    - Distributed energy resources like rooftop solar, behind-the-meter storage, and smart appliances, while not typically the least expensive resource on a levelized cost of energy basis, provide a number of resiliency benefits in addition to cost savings for customers, and so are important to include in the 2024 IRP. These resources can be modeled separately and included as a decrement to the load forecast, or can be modeled similar to energy efficiency as a resource where blocks of specific programs are available for the model to select. We recommend a combination: set expected baselines that are accounted for in the load forecast and allow the model to select programs based on both costs and benefits, including hourly profiles.
4. The 2024 IRP should include a modern reliability analysis, not just a planning reserve margin for one or more peaks per year.
    - The days when a utility could plan its system using only one, or even two, peak load hours a year plus a reserve margin are no longer adequate. TVA itself experienced how reliability events can occur outside of modeled conditions and contingencies when it had to implement rolling blackouts in December 2022 during Winter Storm Elliott. We recommend that TVA IRP staff review work by Telos Energy for the Energy Systems Integration Group, summarized in a blog and report.[2] We recommend that TVA integrate these

[2] Telos Energy for ESIG blog titled "Beyond 1-day-in-10-Years: Measuring Resource Adequacy for a Grid in Transition," published November 2021 is available here: https://www.esig.energy/beyond-1-day-in-10-years-measuring-resource-adequacy-for-a-grid-in-transition/. Report titled "Redefining Resource Adequacy for Modern Power Systems," published in 2021 is available here: https://www.esig.energy/wp-content/uploads/2022/12/ESIG-Redefining-Resource-Adequacy-2021-b.pdf.

recommendations into the resource adequacy analysis in its 2024 IRP, including using a suite of reliability metrics such as expected unserved energy (EUE) and not treating any capacity resource as a perfect capacity resource. We recommend that TVA contract with Telos Energy, a consulting firm, to inform updates to the resource adequacy analysis to be used in its 2024 IRP.

- Just as there is no perfect capacity resource, each supply-side and demand-side resource provides different sets of benefits. Since solar resources continue to provide energy during summer peak hours, that is a clear benefit that should be accounted for in resource adequacy modeling. We recommend that TVA model several configurations of solar and other resources to be able to capture potential benefits beyond energy provided. For example, solar can be oversized, allowing it to provide grid services such as spinning reserves, load following, voltage support, and frequency response, such as was observed in this study by E3 for Tampa Electric and First Solar.[3] Similarly, batteries can be operated flexibly, where a 4-hour battery can be discharged at half its capacity and therefore act like a smaller 8-hour battery. This allows for a much more comprehensive view of each resource than simply assigning one or two capacity values for the two peaking seasons.

5. The 2024 IRP should model current and forward-looking storage technologies, and include all the benefits such technologies provide to the grid.
   - Energy storage technologies have come a long way since TVA's 2019 IRP, and should be a cornerstone resource in the 2024 IRP. We recommend the 2024 IRP include a variety of storage technologies, both long and short duration, with the ability of the model to pick modular chunks of capacity to meet specific needs.
6. The 2024 IRP should look at wind energy resources both within the Valley and external.
   - Wind energy in the Southeast is being considered as an alternative renewable resource to solar in several jurisdictions surrounding TVA, including by Georgia Power in its 2022 IRP and by Duke in its 2022 Carbon Plan. With improvements to wind technologies, we recommend that TVA take a science-based approach to inclusion of wind energy resources within its territory.
   - With improvements to transmission, including discussions of national build-out of high voltage direct current transmission lines and other transmission lines of national interest, it is likely that importing wind from the midwest into TVA will become significantly easier and less expensive within the timeframe analyzed in this IRP. Therefore we recommend that TVA include a scenario in which TVA participates in the build-out of a national transmission system to connect high renewable resource areas and high load centers both within TVA's service territory and on all sides of the Tennessee Valley.
7. The 2024 IRP should use the latest forecasts for resource costs.
   - The National Renewable Energy Laboratory (NREL) recently released its 2023 Annual Technology Baseline (ATB), the gold standard for resource cost forecasts. We recommend that TVA use NREL ATB values for baseline resource costs in its draft IRP, and since the 2024 ATB is likely to be released in June or July of 2024, TVA should evaluate whether or not it can use those updated resource cost forecasts for its final IRP to be released in 2024.

[3] E3 Report titled "Investigating the Economic Value of Flexible Solar Power Plant Operation," published in October of 2018 is available here: https://www.ethree.com/wp-content/uploads/2018/10/Investigating-the-Economic-Value-of-Flexible-Solar-Power-Plant-Operation.pdf.

8. The 2024 IRP should use gas price forecasts that account for the price volatility risk of such markets due to global and political events like the recent impact the war in Ukraine has had on gas prices.
    ○ Fuel price forecasts generally are difficult to get right, but natural gas price forecasts are particularly tricky. After a decade of low gas prices and sustained low gas price forecasts, geopolitical events in the past two years have driven price volatility unseen since before the widespread adoption of fracking. While it helps to have some accounting for the possibility of these events in baseline price forecasts, it is all the more important to have reasonable upper bounds on the forecasts used for sensitivity analysis. We recommend that TVA employ high and highly volatile forecasts for gas prices in its sensitivity analysis as a risk mitigation tool for TVA ratepayers. Since fuel costs are passed directly on to customers, and not accounted for in affordability metrics used for executive compensation, it is important for TVA to be transparent about what shocks to the price of natural gas could do to customer bills.
9. The 2024 IRP should include at least one scenario where TVA is required to comply with the EPA's proposed greenhouse gas regulations on new and existing coal and gas power plants.
    ○ In May of 2023 the EPA announced proposed Greenhouse Gas Standards and Guidelines for Fossil Fuel-Fired Power plants.[4] These regulations, even if they are significantly modified before becoming final, could have significant impacts on TVA's existing and proposed fleet of fossil fuel resources. TVA currently has the largest proposed gas build-out of any utility in the country, meaning the regulations for new gas power plants can have a particularly large impact on TVA customers if TVA is not prepared. We recommend that TVA include these regulations in its baseline scenario, and only have one scenario without some accounting for the EPA regulating GHG from fossil fueled power plants, as it is required to do by the Supreme Court.
    ○ TVA should be sure to apply the correct rules to its resources when modeling them in the 2024 IRP. The EPA's rule for new resources will apply to any resource that wasn't under construction when the EPA published its proposed rule in the Federal Register, which it did on May 23, 2023. Meaning new gas plants at Cumberland, Kingston, and Cheatham County will all be considered "new" plants under these EPA regulations.
10. The 2024 IRP should include at least one scenario where TVA models coal retirements endogenously to determine if it is appropriate to adjust its current coal retirement planning assumptions.
    ○ TVA has set planning assumptions for the retirement of all of its coal units by 2035. While these are likely to be used by the model for the 2024 IRP, the capacity expansion model TVA is using for the 2024 IRP (EnCompass) allows for the option to endogenously model coal retirements based on a set of assumptions that include the continued cost to operate each unit. We recommend that TVA perform at least one scenario where it allows EnCompass to endogenously retire its coal units, and compare the timing, costs, reliability, and emissions impacts of a different coal retirement schedule to the one already developed by TVA.
11. The 2024 IRP should include at least one scenario where proposed gas plants at Cumberland, Kingston, and Cheatham County are not locked-in, but made as selectable resources to the

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[4] Regulatory text, EPA's power system modeling, and additional technical support documentation for the proposed rules are available here: https://www.epa.gov/stationary-sources-air-pollution/greenhouse-gas-standards-and-guidelines-fossil-fuel-fired-power.

model, to allow the model to endogenously choose replacement generation resources for coal retirements.

- An IRP is a chance for a utility to perform system-wide analysis on the best resource options for the future. To date, TVA has begun three major resource decisions under the 2019 IRP despite the fact that those resources will not be operational for years after the completion of the 2024 IRP. In order to best optimize its future resource portfolio, we recommend that TVA include at least one scenario in the 2024 IRP that does not lock in the resources proposed to replace the Cumberland and Kingston coal plants, as outlined in TVA's final Cumberland Record of Decision, Kingston DEIS, and Cheatham County Notice of Intent.

12. The 2024 IRP should include at least one scenario that achieves 100% decarbonization, or near 100% decarbonization, of TVA's entire generation fleet by 2035, in line with the state goals of the Biden administration.
    - In January 2021, President Joe Biden signed an Executive Order on that, among other things, sets a goal for a carbon-free electricity sector no later than 2035.[5] That goal is in line with climate science and decarbonization strategies that recognize how important it is for decarbonization of electricity to occur well before decarbonization of the rest of the economy. TVA's current decarbonization goals and strategies are not in line with the Biden Administration's goal or climate science, and the main reason TVA has cited for its divergence is the presence of the least-cost planning clause in the TVA Act. Well, TVA's 2024 IRP is a perfect opportunity for TVA to show if and how least-cost planning and decarbonization by 2035 are out of step, but it can only do so by including at least one scenario that achieves decarbonization by 2035. We recommend that TVA include multiple scenarios that achieve fully carbon-free power generation by 2035 in its 2024 IRP so that different pathways and potential cost trajectories can be evaluated.
13. The 2024 IRP should include all financial incentives available through the Inflation Reduction Act (IRA), and include resources that TVA contracts for through Power Purchase Agreements (PPAs) as well as selectable TVA-built resources for solar and storage, where the price includes TVA's elective pay incentive.
    - Guidance on clean energy financial incentives has largely already been released, and will continue to be released as TVA prepares to begin its IRP modeling, so TVA should be able to fully incorporate all IRA incentives into its 2024 IRP analysis.
    - Since the IRA allows elective pay, TVA is now able to directly take advantage of clean energy tax credits. Therefore we recommend that TVA model both continuing to use PPAs for clean energy resources as well as direct development and ownership of clean energy resources by TVA. There may be a point in TVA's development maturity and resource cost trajectories where it makes sense for TVA to begin to self develop clean energy resources, instead of or in addition to relying on contracts with third party developers.
14. The 2024 IRP should also consider grants and other funding sources available to TVA through the IRA for projects such as transmission and generation resources to displace fossil resources, either through a separate scenario or sensitivities around the costs of these resources.
    - Beyond the clean energy financial incentives, the IRA includes a variety of programs targeting clean energy development, reduction of greenhouse gas emissions, improving

[5] Executive Order on Tackling the Climate Crisis at Home and Abroad, signed January 27, 2021; text available online here: https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/.

environmental justice and energy communities, and clean energy in rural communities. TVA's 2024 IRP should include a comprehensive evaluation of all the opportunities available so that TVA customers are not missing out on the opportunity for cost savings and emission reductions.

15. The 2024 IRP should include consideration of direct energy efficiency and clean energy tax incentives and rebates through the IRA in its load forecast.
    - The IRA expanded the available tax incentives and rebates for energy efficiency, electrification, and installation of solar and/or storage on homes and businesses. We recommend that TVA include these incentives, and an analysis on the potential adoption of each across its territory, when it develops the range of load forecasts to be used in the 2024 IRP. Notably, these incentives will impact not just total energy demand, but also peak demand where there are replacement of electric resistance heating or old heat pumps with new energy efficient and cold climate heat pumps, or where there are replacement of gas furnaces with new energy efficient and cold climate heat pumps. Solar and storage on homes and businesses will also have an impact on summer peak forecasts.

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#31]
Date:	Monday, July 3, 2023 4:41:07 PM

Name	Lisa Gordon
City	Murfreesboro
State	TN
Email	
Phone Number	

Please provide your comments by uploading a file or by entering them below. *

Please rethink your plans to create new gas pipelines and a methane plant. It is past time to retire these polluting sources of energy and invest more in renewables. Your standard reply is that they are more reliable and we need to have an "all of the above" approach. Wrong! Last winter when you had to implement rolling blackouts, it was the renewables that were the reliable sources. Be forward thinking instead of digging into your well-worn trenches of polluting sources from the past. DO THE RIGHT THING.

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#32]
Date:	Monday, July 3, 2023 5:14:00 PM

Name	ELIZABETH SURFACE
City	Nashville
State	Tennessee
Email	
Phone Number	
Please provide your comments by uploading a file or by entering them below. *	The plan as proposed does not move TVA and it's clients toward renewable energy at an acceptable rate to help save our planet. More solar and wind and no more coal or gas plants should be in the plan for this timeline. Fossil fuels should not be included in the plan and all fossil fuel plants, gas and coal, should be phased out as quickly as possible.

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#33]
Date:	Monday, July 3, 2023 7:46:13 PM

Name	James E Hopf
City	Tracy
State	CA
Organization	Generation Atomic
Email	
Phone Number	

Please provide your comments by uploading a file or by entering them below. *

I'm writing to express general support for including new nuclear (SMRs, etc..) in your future plans.

There is growing expert consensus that we will not be able to get all, or perhaps even most, of our power from intermittent sources, because the amount (and cost) of required storage would be extraordinary. Analyuses show that including a significant amount of firm (non-intermittent) sources like nuclear would significantly reduce overall system cost.

Nuclear would also enhance grid reliability and would provide a larger number of local jobs, that would be both higher paying and much longer lasting than those provided by other clean generation sources. It would also contribute much more to the local tax base. For those reasons, fossil communities have expressed a strong preference for nuclear, as the replacement for their retiring fossil facilities.

From:	Brian Paddock
To:	Integrated Resource Plan
Subject:	Comment in response to TVA Notice to start preparation of a new Integrated Resource Plan (IRP).
Date:	Monday, July 3, 2023 9:06:13 PM
Attachments:	Comment on scope of proposd integrated resource plan 7-3-23.pdf

Attached in PDF

--
Brian Paddock

BRIAN PADDOCK
ATTORNEY AT LAW
7094 Brittney Circle
Baxter, Tennessee 38544
bpaddock@twlakes.net

Comment in response to TVA Notice to start preparation of a new Integrated Resource Plan (IRP).

The 2019 IRP has been a failure. TVA tried to throttle solar development both in the 2019 IRP modeling and on the ground. Only recently TVA welcomed more utility scale solar installed by private investors. Actual and proposed expansions of gas fired generation are touted as being lower in carbon emissions than TVA's aged coal plants. That is damning with faint praise at a time that ALL fossil fuel use must be quickly ended if we are to stop at the edge of the 1.5º C climate disaster precipice.

Since the 2019 IRP was finalized we have suffered greater and more frequent climate disruption events and disasters. As this is written TVA still proposes in the Kingston Draft EIS to expand the use of gas by spending billions of ratepayer and investor dollars to build generation facilities and more millions for the Enbridge (d.b.a. East Tennessee Natural Gas) Natgas pipeline from Nashville to Kingston.

There are none so blind as those who will not see.

The 2024 IRP process must NOT assume that a previously expressed agency preference for much more gas fueled generation and the main pipeline and branch pipelines are built in to TVA's future. The TVA Board has ruled it will decide and vacated CEO Lyash's delegation to make this decision.

If there are any technically and politically smart TVA staff involved the Final Environmental Impact Statement (EIS) for Kingston and the Enbridge pipeline the EIS will state a new Agency Preferred Alternative offering as much solar and storage (short and long term) as necessary (including distributed resources from Local Power Companies (LPCs) along with increases in energy efficiency and other demand reduction programs (DER).

Moreover, the Federal Energy regulatory Commission has not approved the pipeline and a good deal of debate and analyis, as well as litigation stands between Enbridge's (not yet filed) application and the grant of a permit and the associated power of eminent domain.

TVA must be aware that it is under scrutiny by the public and media. CEO Lyash has seen no support and some criticism from members of the House Majority as well as Senator Bill Haggerty.

TVA's switch to gas was challenged by EPA and other experts as wasteful of money and a switch to solar and storage was recommended. EPA's proposed regulations limiting GHG emissions from fossil fueled electrical generation are now a real deterrent to gas. These EPA rules should be clearly explained and acknowledged in the EIS.

While it may be some time before these regulations are in final form and tested by litigation the handwriting is on the wall. To meet these proposed limits TVA will have to either inject hydrogen into the methane fuel to reduce the carbon in the emissions or capture and geologically sequester carbon in the missions.[1]

Neither of these seems an inviting choice for TVA. There is no utility scale hydrogen generation in prospect in the Valley notwithstanding Department of Energy happy talk about "Hydrogen Hubs".

> "In November [2022], Dominion Energy, Duke Energy, Louisville Gas & Electric Company and Kentucky Utilities Company (LG&E and KU), Southern Company and the Tennessee Valley Authority (TVA), along with Battelle and others, announced they had formed a coalition to pursue federal financial support for a Southeast Hydrogen Hub." (https://siteselection.com/issues/2023/jan/tva-floors-the-clean-power-accelerator.cfm

This hub is to serve the entire southeastern U.S. with many existing coal and gas plants and a few planned gas fired plants including those TVA says it wants to spend billions to build. TVA and other big companies are counting on billions of federal dollars, not financing this by themselves.[2]

There is little carbon emissions free surplus electricity to make hydrogen to dilute natural gas that I have discovered. This leaves TVA with a "energy tax" the energy that must be drained from the gas plant's generation to produce hydrogen that is then fed back into the fuel supply.

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[1] These responses are not specifically required by the proposed regulations but the EPA federal register notice makes it clear that these are the only feasible means to meet the carbon emission limits in their view.

[2] Since a Programmatic EIS must consider the future not just the present I suggest that there are many uncertainties with these regulations, with hydrogen, and with carbon capture and sequestration. Renewable energy and storage is a known technology with a much lower risk of failure and stranded assets.

Likewise Tennessee lies over limestone karst and sandstone. These sedimentary strata are full of groundwater passages, aquifers, radium ore lens and cracks and faults. To assure that CO2 emissions are securely contained and will not leak back into the atmosphere they must be pumped into the "basement" rock (igneous or metamorphic) which may be thousands of feet below the surface.[3]

TVA's devotion to gas as a fuel makes no sense. There are ample examples that renewables plus storage can strengthen the grid and provide energy more reliably than fossil gas. My argument is supported by Winter Storm Elliot and TVA's own after action report of the failure of coal and gas fired plants while solar continued to operate serving end user customers and supplied energy for the Racoon Mountain pumped storage.

The new Integrated Resource Plan must move TVA rapidly unto a decarbonized path to zero or at least net zero by 2030. Anything less may help push the planet beyond 1.5º C.

TVA must marshal a new set of resources, recognize new priorities and rapidly devise new policies if it is to serve the Valley residents and be effective as an energy supply and management leader.

I sat on the stake holder committee for the very first TVA IRP as a representative of the Sierra Club. The work before TVA and its constituencies is more formidable than ever before. But we have the necessary technologies to decarbonize electrical generation and we must find the will, skills, and capex to do so.

I look forward to public participation opportunities that will come as the IRP consultation and analyis continues and the DEIS for the Programmatic EIS is released for comment.

Respectfully Submitted,

<u>*/s/ Brian Paddock*</u>
Brian Paddock, Esq.
TBR No. 006968

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[3] See: https://pubs.usgs.gov/pp/1241c/report.pdf

From:	Wufoo
To:	Integrated Resource Plan
Subject:	2024 Integrated Resource Plan [#34]
Date:	Monday, July 3, 2023 10:00:01 PM

Name	John Todd Waterman
City	Clinton
State	TN
Email	
Phone Number	
Please provide your comments by uploading a file or by entering them below. *	Recent science on the urgent threat of multiple, irrevocable global warming feedback loops has made it unequivocally clear that the 2024 Integrated Resource Plan must BEGIN with an absolute commitment to building no new fossil fuel plants and to replacing those currently in operation with renewable energy, energy storage, and energy efficiency as rapidly as possible.

From:	Lindsay Gardner
To:	Integrated Resource Plan; nepa
Subject:	TWF Scoping Comments on 2024 IRP and Associated EIS
Date:	Wednesday, July 5, 2023 3:42:58 PM
Attachments:	TVA IRP Scoping Comments 070323 TWF Final Signed.pdf

Hello Mr. Reed and Ms. Baxter,

Please find attached the Tennessee Wildlife Federation's scoping comments on the 2024 Integrated Resource Plan and associated EIS.

Thank you!

Best Regards,
Lindsay Gardner

Lindsay Gardner | Associate Director, Policy Research/Development & Federal Relations
Tennessee Wildlife Federation
Office:
tnwf.org

TENNESSEE WILDLIFE FEDERATION
Champions of Tennessee's Great Outdoors

July 3, 2023

Tennessee Valley Authority
Attn.: Hunter Reed, Project Manager; Kelly Baxter, NEPA Specialist
400 West Summit Hill Drive
WT 11B
Knoxville, TN 37902-1499

Sent via email to IRP@tva.gov and NEPA@tva.gov

Dear Mr. Reed and Ms. Baxter:

The Tennessee Wildlife Federation appreciates an opportunity to submit scoping comments on the 2024 Integrated Resource Plan (IRP) and to help inform the associated Environmental Impact Statement (EIS). These comments reiterate key points we emphasized in the 2019 IRP - that TVA continue strong stewardship of the environment and natural resources of the region as the agency seeks to develop its Targeted Power Supply Mix and considers alternative energy resource strategies and scenarios.

Renewable Energy

Recent scientific research has found that poorly sited utility-scale solar development negatively impacts wildlife populations, habitat, water resources, and recreational uses like hunting, fishing, and other outdoor recreation pursuits.

As TVA works to expand its alternative energy operations, especially utility scale solar, the Federation urges that solar renewable energy infrastructure development be done in a manner that is protective of wildlife and habitat, and that considers the stability of transmission grids. This includes protecting Tennessee lands from conversion and fragmentation by evaluating alternative sites, or design considerations, through a least conflict solar siting effort (avoiding high value forest, cropland, habitat, cultural, and sensitive species lands) and that involves early collaboration between local and federal solar permitting agencies, developers, and state and federal wildlife agencies.

Additionally, we request that TVA evaluate solar siting on built infrastructure, such as parking lots, rooftops, and other distributed solar on already developed land/brownfields.

As Tennessee is a "low commercial wind" state, we have for some time opposed siting industrial scale wind in Tennessee. The policy of the State of Tennessee with regards to siting wind energy has been codified, and we are unaware of meaningful solutions that adequately address the loss of wildlife (i.e., birds and bats) from wind power.

In regards to energy expansion and diversification, the Federation supports TVA's efforts to provide the region with dependable, clean, safe, and affordable nuclear power. As a key form of renewable energy, we also support the expansion of small modular reactor (SMR) nuclear power as a critical aspect of TVA's generation efforts. We ask that a detailed evaluation of SMRs and their use in the valley receive extensive consideration.

Public Lands and Changing Land Uses

At the time of the release of the 2019 IRP, the Federation noted that it was somewhat unclear as to the potential impacts of energy expansion on public lands such as parks, managed areas, and ecologically significant sites, as well as retirements, with changing land uses. Given the large areas of private lands that are facing energy development in the valley, we feel it imperative that TVA continue to clearly communicate public land use changes (especially those affecting wildlife habitat, boat ramps, hunting, fishing, and wildlife viewing opportunities) and any associated environmental impacts. We do not support the conversion of existing TVA held public wildlife habitat lands or natural areas held by TVA for energy development.

However, we do support, and want to work with TVA to repurpose old fossil generation properties, industrial sites and brownfields owned by TVA for energy development. These sites typically have infrastructure in place to connect new generation to the grid. We strongly support the reuse of these sites and request they be evaluated within the IRP for such purposes.

We encourage the inclusion of these to the fullest extent possible in the draft programmatic EIS, and for individual assessment and review on a case by case basis as required under NEPA to ensure full transparency and opportunity for public awareness and comment.

Sincerely,

Lindsay Gardner

Lindsay Gardner
Associate Director of Policy Research/Development and Federal Relations

TVA

tva.com/irp