December 10, 2024

Kelly Baxter, NEPA Project Manager
Tennessee Valley Authority
400 W. Summit Hill Drive, WT 11B
Knoxville, TN 37902

Subject: Draft IRP Comments from the Tennessee Advanced Energy Business Council

Dear Ms. Baxter:

The Tennessee Advanced Energy Business Council (TAEBC) appreciates the opportunity to comment on the Tennessee Valley Authority (TVA) 2025 Draft Integrated Resource Plan (IRP).

TAEBC champions advanced energy as a job creation and economic development strategy. Advanced energy is technology neutral, anything that makes energy cleaner, safer, more secure and more efficient is in the tent. And it includes electricity and transportation.

The advanced energy sector is vitally important to the state's economy and generates $55.9 billion in state GDP, employs 420,632 Tennesseans, and includes 22,554 businesses.[1]

TVA's final IRP will have an impact on the state's economy, therefore it's critically important to consider the economic impacts of selecting or deprioritizing generation technologies. These decisions affect Tennessee's ability to recruit and retain businesses that require reliable and clean sources of energy, and the workforce that follows.

Draft IRP Alignment with TAEBC's Mission, Vision, and Commitments

TAEBC's mission is to champion advanced energy as an economic development and job creation strategy. We support TVA's overall goal of decarbonization and its three-pronged mission of power generation, environmental stewardship and economic development. Below are the key areas of alignment between TVA's Draft IRP and TAEBC's mission:

1. Commitment to Advanced Energy and Innovative Technologies:
TVA's investment in renewable energy, energy storage, advanced nuclear reactors, carbon capture, flexible generation assets and grid modernization aligns with TAEBC's efforts to

[1] "2024 Advanced Energy Economic Impact Report," Tennessee Advanced Energy Business Council and the University of Tennessee Baker School for Public Policy. November 2004. https://www.tnadvancedenergy.com/advanced-energy-economic-impact-report/

drive economic growth through advanced energy technologies. The IRP's recognition of the importance of advanced energy as central to the future energy mix supports the goal of creating jobs in Tennessee's growing advanced energy sector.

2. Support for Emerging Technologies:
The inclusion of small modular reactors (SMRs) and advanced nuclear technologies, carbon capture, artificial intelligence to manage energy systems, and hydrogen as fuel in the IRP demonstrates TVA's willingness to embrace emerging technologies. These innovations are essential for reducing emissions while maintaining reliable power. TAEBC members are actively engaged in many of these areas, and we applaud TVA's commitment to investing in the future.

3. Focus on Decarbonization:
TVA's goal of net-zero carbon emissions by 2050 aligns with TAEBC's mission and definition of advanced energy. The IRP recognizes that decarbonization is crucial not only for environmental reasons but also for economic competitiveness, particularly as businesses and communities increasingly prioritize sustainability. For a long time, TAEBC has noted that Fortune 100 and 500 companies are driving advanced energy market solutions because of their corporate sustainable plans that require clean energy or emissions reductions. Now, this theme has extended beyond "Fortune" level corporations and into all types of businesses.

4. Energy Efficiency and Demand Response:
TVA's inclusion of energy efficiency and demand response programs in the IRP resonates with TAEBC's support for cost-effective energy management solutions. Expanding these programs can provide significant savings for consumers and businesses, enhancing Tennessee's competitiveness.

Draft IRP Comments and Suggestions: Achieving Net-Zero Emissions by 2050

Modeling Approach & Least Cost Planning

Upon reviewing the IRP's "Process Methodology" and "Portfolio Results and Assessments" sections, we acknowledge that TVA has taken a robust approach to modeling various future scenarios. However, TAEBC has identified areas where improvements could be made:

Transparency of Modeling Assumptions:
TVA's models incorporate a wide range of scenarios and business strategies, but the assumptions behind key inputs (e.g., technology costs, carbon pricing, and demand forecasts) should be more transparent. Providing greater clarity on these assumptions will help stakeholders better understand the basis for TVA's decisions and provide more informed feedback.

For example, according to BloombergNEF (BNEF), the cost of clean energy technologies has been dropping in recent years, driven by falling prices for batteries and solar, and the continued affordability of wind. The LCOEs of utility-scale solar,

onshore and offshore wind have fallen by 58-74% over the decade to 2023, and BNEF expects these cost reductions to continue in the long run thanks to continuing technology improvements, greater economies of scale and reduced financing costs. Additionally, BloombergNEF expects the energy storage market in 2035 to be 10 times larger than it is today. How has TVA incorporated this trend of rapid price drops?

Least Cost Planning:
As discussed in more detail below, we encourage TVA to consider how to better integrate its draft IRP with large customer demand for carbon free energy.

In the same way that TVA has set goals for decarbonization of its system, many large corporations have ambitious plans tied to their electricity emissions profiles. Many corporations require "additionality," meaning that they want their investments in clean energy to deliver new resources to the grid that would not otherwise have been developed. Others are focused on location or time-specific resource deployment.

TVA should consider how large customer demand - specifically by customers who may be contributing to load growth in the Valley - can be leveraged to accelerate decarbonization of TVA's system, without creating rate impacts on other customers.

To date, many utilities view corporate demand for clean energy as siloed off from their resource planning processes, creating missed opportunities to align this market demand towards the highest value system resources. We strongly encourage TVA to consider ways to integrate this corporate demand into resource needs, through existing programs such as Green Invest as well as other pathways that still need to be created. TAEBC is eager to partner with TVA to accomplish this goal.

Customer Demand for Carbon Free Power:
From a customer perspective, electrification remains the number one option to decarbonize industrial fossil fuel fleets (e.g. steam/heat generation).

The IRP appears to view electrification with a regulatory + growth lens. Meaning, electrification is only considered in the net-zero + regulation scenario which only considers the Utility GHG Rule. This scenario does not involve customer facing targets such as Science Based Targets Initiative (SBTi)[2], and it should.

TAEBC members have engaged TVA over the course of multiple years to utilize the Green Invest program. Unfortunately, the Green Invest option is not cost-competitive and the process itself does not seem well defined and opaque.

TVA's 2025 net-zero target is equivalent to SBTi and aligns with many in industry. There is a clear partnership opportunity to meet converging targets. 2050 is only a

[2] For more information on Science Based Targets Initiative visit: https://sciencebasedtargets.org/

mere 25 years from now and, at utility scale, it isn't clear what the decarbonization strategy looks like to achieve the collective 2050 net-zero target.

TVA does allow for local power companies to generate up to 5 percent of their own energy to meet customer demand for new renewables and other local needs. This should be increased and promoted across the region, whereby placing more of the debt burden or operational controls at the local level.

Incorporation of Emerging Technologies:
The IRP models advanced technologies like SMRs, but their commercialization timelines and costs are uncertain and compounded by TVA's debt ceiling. TAEBC recommends additional sensitivity analyses that explore different scenarios where these technologies are either delayed or less cost-effective than expected. This will help ensure that a) TVA's resource plan remains flexible if certain technologies do not become viable as quickly as anticipated or b) additional resources or partnerships are aggressively pursued to meet the desired goal.

We support Strategy C, which looks at deployment of commercially ready carbon free technologies; this has the lowest financial risk exposure of all the strategies, one of the fastest near-term reductions in carbon emission intensity and the best tradeoff of cost and risk exposure overall. But we recommend that TVA consider a strategy that puts equal emphasis on these deployable technologies (solar, wind, battery storage and long-duration storage) while also putting a high focus on nuclear resources in particular. This strategy would account for the early work that TVA has done on new nuclear technology, such as the Early Site Permit for SMRs at Clinch River, and the TVA Board's approval of a "programmatic approach" to exploring advanced nuclear technology. This would allow TVA to prioritize near-term investments in these commercially primed technologies, while also aggressively pursuing new nuclear resources for the medium-term future.

Again, a huge private-equity/industrial partnership opportunity exists to alleviate the debt burden and allow for additional emerging technology asset deployment with shared cost/benefit. There is a tax-equity partnership market that is well suited to help displace some or all the debt burden and allow for zero-carbon energy proliferation. One example is with carbon capture and TAEBC encourages TVA to review and reference, "Utilities and Carbon Removal: A Gigaton Scale Opportunity,"[3] published by Carbon Business Council, before publishing the final IRP.

Risk Management and Scenario Planning:
The stochastic modeling TVA uses for risk assessment is commendable, but more emphasis could be placed on extreme climate-related risks. Given the increasing frequency of extreme weather events, TVA should consider additional modeling for scenarios where the grid is stressed by high levels of demand or renewable

[3] "Utilities and Carbon Removal: A Gigaton Scale Opportunity," Carbon Business Council. September 2024. https://www.carbonbusinesscouncil.org/news/utilities

intermittency. Planning for these conditions is essential for ensuring grid resilience in a changing climate.

Weather patterns have changed as storms and other weather phenomena have become more violent and more frequent. There is no mention of microgrid adoption/evaluation in high risk areas or new construction/developments. Risk management and scenario planning should include microgrid evaluation and deployment strategy across the region, focusing on those areas where isolation/power-loss is probable, and reconnection could be protracted.

Accelerate Renewable Energy Deployment and the Technologies that Support it

The IRP includes solar and wind energy additions, but the pace of adoption could be more ambitious. To ensure a rapid transition to carbon free energy, TVA should consider increasing the annual capacity for solar and wind projects. This could involve removing barriers related to permitting and grid interconnection, as well as promoting policies that encourage private sector investment in renewables.

While the IRP includes DERs, such as rooftop solar and battery storage, their role in the overall energy mix could be expanded. TVA should explore policies and incentives that encourage more widespread adoption of DERs. This could reduce demand on the central grid and provide more localized energy resilience.

TAEBC would like to emphasize the importance of flexible, dispatchable generation to manage the variability in renewable energy production and that reliable, dispatchable power sources are still necessary, particularly in the short term, to maintain grid stability. The future of energy requires that old, inefficient natural gas plants must be replaced with modern, flexible engine or aero power plants, which are significantly more efficient, produce fewer emissions and can run on a variety of fuels. The potential for new thermal technology to burn hydrogen-methane blends, from 1% to 100%, make these new plants crucial for the future hydrogen economy. TVA's investments in new, flexible gas plants could reduce long-term costs and emissions, helping to bridge the gap between fossil fuel dependence and a decarbonized future.

Expand Energy Storage Capabilities and Flexible Assets

Energy storage is critical to integrating variable renewable energy sources like solar and wind into the grid. While the IRP mentions energy storage, TAEBC recommends that TVA explore more aggressive storage deployment scenarios. Specifically, TAEBC members and their industry insights indicate that energy storage costs and performance could advance more aggressively than the IRP assumes under its scenarios. This is consistent with

advanced energy technologies exceeding expectations[4] year over year historically. Knowing this, TVA could consider expanding battery storage capabilities to improve grid reliability, especially during periods of peak demand, and provide the flexibility needed to replace retiring fossil fuel plants.

Incorporate Electrification Trends More Aggressively

Electrification of transportation, industry, and buildings is expected to increase electricity demand significantly in the coming decades. The IRP touches on these trends, but we recommend that TVA accelerate planning for electrification. This includes increasing electric vehicle (EV) infrastructure, encouraging electrification in industry, and preparing the grid to handle higher electricity demand.

As mentioned above, electrification is the only scalable solution for decarbonizing stationary fossil fuel assets used to produce heat & steam.

Set Clear Interim Carbon Targets

While the IRP sets a long-term goal of net-zero emissions by 2050, TAEBC suggests that TVA adopt more specific interim carbon reduction targets for 2030 and 2040. This will help TVA stay on track and ensure accountability. These targets could be aligned with industry standards and federal policy developments related to decarbonization.

TVA may want to consider setting 2030 and 2040 goals that are SBTi equivalent.
We also encourage TVA to incorporate its own carbon emissions targets into its IRP planning scenarios. TVA has already set targets to reduce carbon emissions by 70 percent by 2030, by 80 percent by 2035, and to be net-zero by 2050.[5] It's unclear if TVA accounted for these goals in its IRP modeling. We suggest that TVA model an additional strategy that would meet these targets, which would help reveal the best pathways for meeting these goals.

Enhance Public-Private Partnerships

TVA's public-private partnerships, such as those with Oak Ridge National Laboratory and the University of Tennessee, are commendable. TAEBC encourages TVA to expand these collaborations to include more businesses in Tennessee's advanced energy sector.

[4] "Easy PV, how solar outgrew expectations," IEA, BNEF and Energy Institute. https://www.reddit.com/media?url=https%3A%2F%2Fpreview.redd.it%2Fpredictions-vs-reality-for-solar-energy-growth-v0-zz9p8ekoss7d1.jpeg%3Fauto%3Dwebp%26s%3D60254ce68bba403ce41f22b9598b4845e3e7810c&rdt=51428
[5] Carbon Reduction, TVA website. https://www.tva.com/energy-system-of-the-future/carbon-reduction#:~:text=We%20are%20executing%20a%20plan,be%20net%2Dzero%20by%202050.

Partnering with innovative companies can accelerate the commercialization of emerging technologies and drive job creation in the state.

A critical part of TVA's strategy involves investing in emerging technologies such as hydrogen, carbon capture, and SMRs. TAEBC fully supports these initiatives, and recommends TVA pursue strategic public-private partnerships to accelerate the deployment of these technologies. By fostering deeper collaboration with private sector leaders and academic institutions, TVA can help bring these technologies to market more quickly, creating economic opportunities for Tennessee.

TVA is facing significant load growth, much of which is driven by large customer load (manufacturing, clean tech, data centers and other industries). Many of these customers have their own decarbonization goals, creating an opportunity for TVA to leverage the market demand for clean energy into public-private partnerships that lead to accelerated investments in carbon free generation, at less cost and risk to all ratepayers.

To start, we encourage TVA to model higher participation in its Green Invest program, which supports large customers' clean energy goals by deploying new renewable energy projects in the Valley. The Green Invest program is mentioned once in the IRP draft, in an Appendix, but it's unclear if or how TVA's modeling assumed that the Green Invest program could contribute to new deployment of carbon free resources. We suggest that TVA model additional sensitivities that assume significantly higher demand for Green Invest over the next decade, with an assumption that new industrial load would opt into the program at higher rates.

We also encourage TVA to consider other pathways for commercial and industrial customers to support the deployment of carbon-free energy resources, including nuclear energy, demand-side system resources and storage technologies.

See comments in the Emerging Technologies section regarding private-equity/industry partnerships & tax-equity markets.

Increase Focus on Grid Modernization

As more renewable energy is added to the system, modernizing the grid will become increasingly important to manage two-way power flows and enhance resilience. TVA's plan should prioritize investments in smart grid technologies and infrastructure that can support distributed generation and demand-side management. This will help ensure that the grid can accommodate high levels of renewables while maintaining reliability.
Grid storage expansion, particularly for long-duration storage, would significantly complement TVA's renewable energy portfolio. Technologies such as flow batteries or pumped hydro storage should be explored more aggressively. This would provide backup power during periods when renewables are not generating, improving grid stability.

Economic Development Opportunities in the Context of TVA's 2025 IRP

According to TAEBC's "2024 Advanced Energy Economic Impact Report,"[6] the advanced energy (AE) economy in Tennessee continues to be a robust and critical sector in the state. The choices that TVA makes in its final IRP will have a direct impact on this vital sector of our economy.

For example, TVA's commitment to net-zero emissions can help attract companies looking to invest in states with accessible pathways to meet corporate sustainability goals. Major corporations are increasingly prioritizing sustainability, and Tennessee (Valley) could position itself as an attractive location for corporate headquarters, data centers, and manufacturing facilities by offering access to affordable, reliable, and clean energy.

TAEBC's role in supporting energy startups through the Energy Network in partnership with Launch Tennessee, is a key component of economic growth. TVA could work more closely with startups by creating innovation grants or partnering on pilot projects, like it did with the Spark Cleantech Accelerator at the 2024 Opportunities in Energy event. This could position Tennessee as a center for advanced energy innovation, attracting entrepreneurs and capital investment into the state's growing advanced energy sector. Additionally, expanding advanced energy projects can attract investment, create high-paying jobs, and stimulate local economies.

There are a total of **420,632 AE jobs in Tennessee**, which represent 14.8 percent of all jobs in the state across all business sectors. Annual payroll spending associated with the AE sector totaled $31.1 billion, and there were **22,554 AE establishments in the state**. The findings imply that the average annual wage for an AE worker is $74,025, which is significantly higher than the state's average salary across all sectors of $56,609. Consistent with the previous reports, AE manufacturing continues to be the largest AE employer in Tennessee, followed by AE utilities and construction and AE professional, scientific, and technical services.

The AE sector in Tennessee has continued to grow at an impressive rate. Since 2019, AE employment increased by 6.8 percent, and AE establishments increased by 10.9 percent. Over the same time period, total employment and total establishments across all sectors in the economy in the state increased by 4.5 and 5.8 percent, respectively. The AE sector has not only grown faster than the overall economy since the last report, but the AE sector has grown faster than the overall economy over the last decade. For example, AE employment increased by 29.5 percent between 2013 and 2022 while total employment across all sectors increased by 18.9 percent over the same time period.

The AE sector is vitally important to the state's economy and generates **$55.9 billion in state GDP**, which represents 11.5 percent of total GDP for the state.

[6] "2024 Advanced Energy Economic Impact Report," Tennessee Advanced Energy Business Council and the University of Tennessee Baker School for Public Policy. November 2004. https://www.tnadvancedenergy.com/advanced-energy-economic-impact-report/

This updated report illustrates how Tennessee's AE sector contributes significantly to the state's economy and creates increasingly more opportunities for companies and Tennessee residents. The AE sector has grown faster than the overall economy, and it is evident that this growth will continue as consumers and producers seek more energy efficient products and manufacturing processes.

Conclusion

Thank you for the opportunity to comment and serve on the TVA IRP Working Group. We look forward to ongoing collaboration to help TVA become the energy company of the future.

Sincerely,

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