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Submitted via email to nepa@tva.gov; and aapilakowski@tva.gov

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Appalachian Voices' Comments on TVA's Draft Environmental Impact Statement for the Cumberland Fossil Plant Retirement

Dear Ms. Pilakowski,

Please accept and submit for the record our organizational comments included hereing on the Draft Environmental Impact Statement for the Cumberland Fossil Plant retirement. We appreciate your attention and consideration of our comments. Please reach out anytime if you have any questions.

Kind regards,

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Executive Summary and Recommendations

Background

The Tennessee Valley Authority (TVA) is developing a pathway to close the Cumberland Fossil Plant (CUF) and has prepared a Draft Environmental Impact Statement (DEIS) for public review and comment. Appalachian Voices finds that in the DEIS for Cumberland, TVA has failed to consider a reasonable range of carbon-free energy alternatives for replacing capacity at the plant, as required by NEPA and mandates from the President of the United States.

Despite urging from local stakeholders, TVA failed to consider a portfolio for Cumberland that incorporates multiple cost-effective, reliable, and carbon-free resources, including energy efficiency, wind, demand response, distributed solar and utility scale solar and storage capacity. Of the three options that TVA did consider in its DEIS, only Alternative C outlines a carbon-free portfolio of utility-scale solar and storage. This option is problematic in both its design and evaluation. Energy efficiency and demand-response were not included in Alternative C, in spite of these often being the lowest-cost resources available to a utility. EE also improves grid reliability and reduces operation costs. Importantly, residential energy efficiency programs are among the best practices to reduce energy burden for low-income households, contributing to achieving the equity and environmental justice mandates of the Biden Administration.

Furthermore, TVA did not fairly or adequately consider the socio-economic and environmental impacts of Alternative C. For instance, in the Socioeconomic Impacts section of TVA's DEIS, TVA evaluated the job outcomes of its methane gas Alternatives A and B, but failed to do so for the solar and storage Alternative C. Clearly, TVA did not give serious consideration to its only non-gas alternative for Cumberland.

Implementing a Clean Energy Portfolio (CEP) to replace Cumberland would provide significant savings to TVA's ratepayers, while also significantly reducing GHG emissions in comparison to TVA's preferred gas alternative. Details on these outcomes can be found in comments submitted by the Southern Environmental Law Center *"Conservation Groups' Comments on TVA's Draft Environmental Impact Statement for the Cumberland Fossil Plant Retirement".*

For the purposes of these comments, Appalachian Voices has produced an analysis and comparison of the jobs outputs of three resource portfolios that include energy efficiency (EE), solar and battery storage and other clean energy options, each of which provide a reasonable alternative to TVA's preferred approach for replacing the generation from TVA's Cumberland Fossil Plant, which TVA plans to retire in the coming years.

Portfolios we analyzed include:

1. A 4,740 megawatt (MW) CEP portfolio modeled and provided to Appalachian Voices by the Southern Alliance for Clean Energy (SACE) that reflects a diverse resource mix including energy efficiency, winter demand response, solar distributed energy resources, onshore wind, midwest wind, utility-scale solar and 4-hour battery storage.
2. A 3,194 MW CEP portfolio modeled and provided to Appalachian Voices by the Rocky Mountain Institute (RMI) which was produced using RMI's Clean Energy Portfolios Model (CEPM) and includes energy efficiency, utility-scale solar and both one-hour and two-hour battery storage.
3. A 3,302 MW Sierra Club portfolio, also produced using RMI's CEPM, that includes energy efficiency, winter demand response, midwest wind, utility-scale solar and one-hour and two-hour battery storage.

Details for the three CEP portfolios are shown in Table ES-1.

Table ES-1: Resource mix for three Clean Energy Portfolio alternatives

	SACE	RMI	Sierra
Energy efficiency	550	854	676
Winter demand response	90	-	71
DER solar	1,450	-	-
Onshore wind	600	-	-
Midwest wind	140	-	475
Utility-scale solar	1,550	2,060	1,142
Battery storage	360	280	668
Portfolio total (MW)	**4,740**	**3,194**	**3,032**

Given that our comments focus strictly on the net job creation benefits of CEP alternatives, we do not conclude or assert that any of the above portfolios is preferred in any way in comparison to the other two, whether based on cost, resources included in the respective portfolios, or job impacts. Each of the three portfolios was provided to us as a reasonable portfolio serving as a sufficient replacement of the capacity and energy generation of the Cumberland coal plant. Further, the RMI and Sierra Club portfolios were each presented as serving as a lower-cost alternative to TVA's preferred Alternative A, which includes a 1,450 MW natural gas combined cycle (NGCC) plant and a 32-mile pipeline.

The summary results of our job impacts analysis are provided in Table ES-2 below. As shown in the table the three CEP alternatives would create and/or support an average of 4,642 direct short-term jobs and 765 long-term jobs, which is 4.6 times more short-term direct jobs and 20 to 30 times more long-term jobs than what TVA has estimated for the NGCC plant and associated pipeline in its preferred Alternative A.

In total, including indirect and induced impacts, the CEP alternatives would create and/or support an average of more than 9,000 short-term jobs and nearly 1,500 long-term jobs. TVA does not provide estimates of indirect and induced job impacts from the proposed Alternative A.

Table ES-2: Jobs impact of three Clean Energy Portfolio alternatives as compared to TVA's Alternative A

	SACE	RMI	Sierra	CEP Average	TVA Alt. A
Direct jobs					
Short-term	4,800	5,291	3,835	**4,642**	1,000
Long-term	879	783	631	**765**	25-35
Total jobs					
Short-term	9,396	10,513	7,374	**9,094**	n/a
Long-term	1,709	1,534	1,226	**1,490**	n/a

Table ES-3 details the net present value (NPV) cost (investment) required to achieve each of the three CEP alternatives. Again, both the RMI and Sierra Club CEP portfolios were developed in a manner that resulted in a resource mix that is sufficient for replacing the energy generated by the Cumberland coal plant while also being cost competitive with a new NGCC plant. A detailed breakdown of the cost for individual resources is provided in Table 1 later in the comments, and those detailed costs were used as the inputs for modeling job impacts.

Table ES-3: Estimated cost of three Clean Energy Portfolio alternatives

	SACE	RMI	Sierra	CEP Average
NPV cost (million $)	$2,142.1	$1,878.8	$1,640.1	$1,887.0

Because of TVA's plans to rapidly and substantially expand its overall gas generation, we also offer an analysis of the jobs and energy savings outputs that would result from moderate to substantial investments in energy efficiency across the TVA footprint between 2022 and 2035 should TVA choose to meet projected future demand through efficiency rather than gas. For the analysis we modeled a scenario where TVA achieves a one percent annual reduction in electricity sales compared to prior year sales through energy efficiency investments as well as a three percent scenario. For both scenarios our model calculates the annual and cumulative electricity savings by sector (residential, commercial and industrial), the annual investment required to achieve those savings for each sector, and the number of net direct, indirect and induced jobs created on an annual basis as a result of those investments.

As shown in Table ES-4, if TVA committed to either a one percent or three percent annual reduction in electricity sales from energy efficiency investments through 2035 a substantial amount of energy savings could be achieved, reducing costs for customers while also avoiding the need for a significant amount of new generation.

Under the one percent scenario, sales in 2025 would be four percent lower than in 2021 and 13 percent lower by 2025. Under the three percent scenario that would be 11 percent and 35 percent, respectively.

Table ES-4: Annual and cumulative electricity savings from a 1% and 3% energy efficiency target

	2025		2035	
	1% target	3% target	1% target	3% target
Cumulative MWh saved	5,742,262	16,716,041	19,127,401	50,591,450
Percent of 2021 sales	4%	11%	13%	35%

Achieving both the one percent and three percent scenarios would require a substantial amount of investment, much of which would benefit the local workforce. As detailed in Table ES-5, the amount of investment required to achieve a one percent annual savings would be approximately $70.8 million in 2022, dropping to $62.1 million by 2035 (as "prior year sales" declines due to prior year energy efficiency investments), for an annual average of $66.4 million over the modeling period. Under the three percent scenario, investment in 2022 would total $212.4 million, dropping to $142.9 million in 2035, for an annual average of $175.5 million. Total investment over the modeling period would be $929.1 million for the one percent scenario, and nearly $2.5 billion for the three percent scenario.

Table ES-5: Annual investment required in select years for a 1% and 3% energy efficiency scenario (in million dollars)

	2022	2025	2030	2035	14-year average	14-year total
1% target	$70.8	$68.7	$65.3	$62.1	$66.4	$929.1
3% target	$212.4	$193.8	$166.4	$142.9	$175.5	$2,457.5

In terms of job impacts, as shown in Table ES-6, energy efficiency investments that achieve either a one percent or three percent annual electricity savings would create and/or support thousands of jobs between 2022 and 2035. Taking both the positive jobs impacts (direct implementation investments and expenditure of customer savings on lower bills) and the negative impacts (program costs and utility revenue losses) together, a one percent scenario would create/support an average of 1,892 net annual direct jobs over the 14-year modeling period, while a three percent scenario would create an average of 5,203 net direct jobs. Total jobs created and/or supported would amount to 5,930 and 16,349, respectively.

Table ES-6: Net job impacts from a 1% and 3% energy efficiency scenario

	2022		2035		14-year average	
	1% target	3% target	1% target	3% target	1% target	3% target
Direct	405	1,214	3,321	8,735	1,892	5,203
Indirect	183	549	1,672	4,403	942	2,593
Induced	338	1,015	5,745	15,228	3,096	8,553
Total	**926**	**2,778**	**10,738**	**28,366**	**5,930**	**16,349**

Conclusions and Recommendations

In summary, the CEP scenarios we have analyzed show how energy efficiency resources can be deployed *alongside* renewable energy sources and battery storage to replace capacity from the Cumberland fossil plant that is scheduled to ramp down beginning in 2026 and fully close by 2033, while also creating a significant number of both short- and long-term jobs in the process. We also demonstrate how modest, but sustained energy efficiency investments can bolster local economies across the TVA footprint and create long-term jobs. TVA should give serious consideration to how investments in energy efficiency could reduce overall electricity demand and the need for additional gas resources, even while supporting the expansion of electric vehicle use in the region.

Prioritizing clean energy resources can meet TVA's needs while creating jobs, potentially lowering energy bills and reducing energy burden for residents and businesses, attracting investment, advancing economic development in the Tennessee Valley, and achieving a central pillar of TVA's mission to steward the region's land and water.

In light of these findings, Appalachian Voices recommends that:

1. TVA should examine the ability of energy efficiency and demand response to reduce the amount of replacement generation needed at Cumberland and other sites and to maximize the beneficial jobs impact on the Tennessee Valley region as a whole.
2. A Clean Energy Portfolio is a reasonable alternative for replacing the capacity at the Cumberland Fossil Plant and would generate tremendous employment benefits for the region. TVA should conduct a *full* environmental review under NEPA that includes a CEP alternative for Cumberland.
3. TVA should select a carbon free energy alternative for replacing the capacity at the Cumberland Fossil Plant to meet the climate, equity, and clean energy goals of the Biden Administration and avoid building out new gas generation as proposed in Alternatives A and B.

Methodology

To evaluate the macroeconomic impacts of the policies and investments examined in this analysis, we used the IMPLAN model. IMPLAN is an input-output (I/O) model available at multiple regional scales. For this analysis, we created a region consisting of the states in which TVA has a substantial presence: AL, GA, KY, MS, and TN. Our analysis and results treat the region as a single entity, and we report our results in terms of impacts on the region as a whole.

IMPLAN assesses the relationships between the various sectors of the economy, as well as household and government institutions, using the linkages between them to determine the impacts of changes in any one of them. Input-output analyses generally begin with a change in final demand for a commodity, or an increase in output from a specific industry which creates ripple effects through the entire economy as a result of supply chain purchases and payments to labor and other factors of production.

The analysis for replacing the Cumberland fossil plant with any of three selected CEP portfolios is focused on the economic implications of installing a wide range of clean energy and energy efficiency measures to offset the electricity supply represented by the closing of the Cumberland plant. It does not attempt to assess the broader economic impacts of energy savings, the benefits of reduced pollution, or other impacts associated with a shift away from Cumberland electricity generation to renewable and efficiency resources. Rather, it looks only at the economic impacts of installing wind, solar, and energy efficiency resources. For that analysis we begin by using the inputs for capacity and associated cost provided by SACE, RMI, and the Sierra Club as detailed in Tables ES-1 and ES-3 and incorporating the cost values for each selected energy resource into IMPLAN to generate results for the number of direct, indirect and induced jobs per million dollars of investment for that resource. Table 1 details the total cost of each resource for the three selected CEP portfolios. These values are disaggregated into capital expenditures (CapEx) and operational expenditures (OpEx) for the purpose of calculating short- and long-term job impacts, respectively, in the next section.

Table 1: Detailed costs for three Clean Energy Portfolio alternatives (million $)

Resource	SACE	RMI	Sierra
Energy efficiency			
Residential	$124.7	$51.3	$49.6
Commercial	$141.3	$252.4	$98.8
Industrial	$120.4	$190.6	$0.0
Winter DR	$26.2	$0.0	$12.3
DER Solar	$0.0	$0.0	$0.0
Onshore wind	$537.4	$0.0	$0.0
Midwest wind	$134.3	$0.0	$455.6
Utility-scale solar	$839.4	$1,115.6	$618.4
Storage	$218.3	$269.0	$405.4
Total	**$2,142.1**	**$1,878.8**	**$1,640.1**

To model the impacts on energy efficiency investments, we began by modeling two future energy efficiency scenarios in order to calculate the annual energy savings that would be achieved through energy efficiency investments for the years 2022 through 2035. The first scenario envisions new energy efficiency investments achieving an annual one percent reduction in energy demand compared to prior year retail sales, while the second envisions a three percent annual reduction. The baseline year used was 2021 but reflects 2020 data reported by TVA to the federal Energy Information Administration. Annual energy saved was then calculated for each year from 2022 to 2035 based on either the one percent or three percent reduction from prior year sales. Because the job impacts per million dollars of those investments will vary depending on whether the investments are made in the residential, commercial or industrial sector, the energy savings calculation was applied individually to these three sectors.

To calculate the value of the annual and total energy efficiency investment by sector, this study relied on comprehensive research conducted by the Lawrence Berkeley National Laboratory (LBNL), which has produced nationwide averages for program administrator and customer costs, per kilowatt-hour saved, from utility residential, commercial, and industrial energy efficiency programs. Modeling the total job impacts from such investments required using the total of those two values, as reflected in Table 2 below.

Table 2: Cost of utility energy efficiency programs per kilowatt-hour saved, by sector

Sector/Cost	Program admin	Customer	Total
Residential	$0.022	$0.017	**$0.039**
Commercial	$0.027	$0.028	**$0.055**
Industrial	$0.027	$0.028	**$0.055**

Note: Commercial and industrial values are the same as a result of utilities typically combining these two sectors in their programming and associated reporting.

For the purposes of generating more accurate job impacts, the annual values for residential energy efficiency investment were disaggregated by specific building improvements and lighting and appliance upgrades. This was made possible through the use of reported averages for specific improvements from the Knoxville Energy Efficiency Makeover, Knoxville Weatherization Assistance Program and Knoxville Operation Round-Up programs. Table 3 details the percent of total investment for specific improvements resulting from these three programs combined.

Table 3: Percent of program investment for specific improvements and upgrades

Air sealing	Insulation	HVAC repair/seal	HVAC replace	Hot water replace	Windows & doors	Other appliance
4%	18%	17%	41%	9%	8%	2%

We then incorporated our sector-specific annual investment values into the economic impact analysis tool, IMPLAN, to build a model of the TVA region. Within IMPLAN we modeled four main vectors of economic activity and traced their impacts throughout the region. We call these four vectors implementation, gross savings, consumer costs, and utility losses.

Implementation represents the gross impacts of purchases of materials and the labor required to install them. The gross savings vector represents the gross impacts of reduced energy costs for energy consumers. The consumer costs vector represents the costs the efficiency measures paid both by participants as well as non-participants through the rate base. The utility losses vector represents the reduced revenue for utilities (and generators) resulting from increased efficiency. Taken together these four vectors represent the net impact on final demand in the economy, as applied to purchases of the relevant commodities and output by the relevant industrial sectors. IMPLAN uses these final demand calculations to determine the overall impact on the regional economy, taking into account issues such as the regional production, imports and exports.

We modeled each of these four vectors for residential, consumer, and industrial efficiency programs, each with two separate efficiency targets (1% and 3% annual reductions) for a total of 24 separate impact analyses. We modeled the impacts of efficiency investments over the 14 year window from 2022-2035.

IMPLAN also captures three levels of cascading economic impact beginning with the direct effects that come from changes in employment and spending. In our model, these are the benefits from initial energy efficiency or renewable energy investment and the costs of energy savings that lead to lost revenue for the utility over time as less electricity is demanded for the same processes. The industries that might be directly impacted include energy generation and construction. These investments spur ripple effects due to linkages with other industries and processes in the supply chain. In this study, we report the indirect effects of changes in the energy portfolio. This captures shifts in demand for supplies like fuel, solar panels, or caulk, which stem from the initial change in energy investment. Finally, it is important to consider the multiplier effects that shifting the balance of energy resources has for the wider economy. Energy is connected to every part of our daily lives at home and work. Our study reports the induced effects of a changing energy portfolio in industries not directly related to the initial investment as the income and spending of households, employees, and businesses change. Some of these effects are negative as certain areas witness changes in localized investment. On net, we see that the primary effects for both employment and economic output are positive as customers might be able to save on their bills each month to spend on other things.

It is important to note that like most input-output models, IMPLAN is static, in the sense that it relies on the economic structure of an economy and its interrelations as they exist in a particular year. IMPLAN makes no attempt to project how those interrelationships might change over time. For this analysis, we used the 2019 model, avoiding 2020 data which are likely to be highly specific to conditions under the COVID-19 pandemic, and the resulting economic upheaval. 2020 data is likely to be a less accurate representation of the economy over the long run, and data for 2021 is not yet available. Our model thus represents what the impacts on the regional economy would be if the economy remained similar to what it was in 2019. This is obviously a simplification as the economy is likely to change over time, and it represents a shortcoming common to input-output analyses. However, we feel the timeframe is sufficiently short and the economic data sufficiently robust to provide meaningful results at a level of regional aggregation not available in other, more dynamic, modeling platforms.

Results of the Analysis for the Three Alternative Clean Energy Portfolios

Overview of three Clean Energy Plan alternative resource portfolios

In response to TVA's failure to examine the economic impacts of clean energy alternatives to its methane gas alternatives, Appalachian Voices has produced an analysis and comparison of the jobs outputs of three Clean Energy Plan (CEP) resource portfolios. These portfolios each include a unique mix of resources including energy efficiency (EE), solar and battery storage and other clean energy options, each of which provide a reasonable alternative to TVA's preferred approach for replacing the generation from TVA's Cumberland Fossil Plant, which TVA plans to retire in the coming years. Additionally, the portfolios modeled by the Rocky Mountain Institute (RMI) and the Sierra Club represent cost-effective portfolios that are less expensive than the cost of a new NGCC plant, especially if that plant also requires the construction of a new 32-mile pipeline, as proposed in TVA's preferred Alternative A.

The three Clean Energy Plan (CEP) portfolios we analyzed include:

1. A 4,740 megawatt (MW) CEP portfolio modeled and provided to Appalachian Voices by the Southern Alliance for Clean Energy (SACE) that reflects a diverse resource mix including energy efficiency, winter demand response, solar distributed energy resources, onshore wind, midwest wind, utility-scale solar and 4-hour battery storage.
2. A 3,194 MW CEP portfolio modeled and provided to Appalachian Voices by RMI which was produced using RMI's Clean Energy Portfolios Model (CEPM) and includes energy efficiency, utility-scale solar and both one-hour and two-hour battery storage.
3. A 3,302 MW Sierra Club portfolio, also produced using RMI's CEPM, that includes energy efficiency, winter demand response, midwest wind, utility-scale solar and one-hour and two-hour battery storage.

Resource and capacity details for the three CEP portfolios are shown in Table 4.

Table 4: Resource mix for three Clean Energy Portfolio alternatives

	SACE	RMI	Sierra
Energy efficiency	550	854	676
Winter demand response	90	-	71
DER solar	1,450	-	-
Onshore wind	600	-	-
Midwest wind	140	-	475
Utility-scale solar	1,550	2,060	1,142
Battery storage	360	280	668
Portfolio total (MW)	**4,740**	**3,194**	**3,032**

The costs for each of these three portfolios is detailed in Table 1, with costs for energy efficiency broken out into residential, commercial and industrial sectors.

Analytical Results for Job Impacts

As noted previously, to calculate the jobs that would be created for each of the three CEP portfolios we input the cost values into IMPLAN, which produced results for direct, indirect and induced jobs. However, we also calculate which of those jobs are direct short-term (e.g. construction) jobs and long-term (e.g. operations and maintenance) jobs, as well as which of the indirect and induced jobs are created and/or supported by short-term and long-term activities associated with the build-out of the resources within each portfolio. Short-term jobs are assumed to be those created/supported as a result of capital expenditures (CapEx), while long-term jobs are assumed to be those created/supported as a result of operations and maintenance expenditures (OpEx).

As an example, Table 5 details the CapEx cost for each resource within the RMI portfolio and the resulting direct, indirect and induced jobs. We treat those job impacts as short-term jobs. As shown, the RMI CEP portfolio would create/support 4,800 direct and 9,396 total short-term jobs.

Table 5: Short-term job impacts of RMI's Clean Energy Plan portfolio

Resource	Capacity	CapEx ($M)	Direct	Indirect	Induced	Total jobs
Energy efficiency	550					
Residential	177	$124.7	596	133	377	1,106
Commercial	201	$141.3	521	124	438	1,084
Industrial	171	$120.4	565	334	305	1,203
Winter DR	90	$26.2	n/a	n/a	n/a	n/a
DER Solar	1,450	$0.0	n/a	n/a	n/a	n/a
Onshore wind	600	$368.1	504	151	309	965
Midwest wind	140	$92.0	126	38	77	241
Utility-scale solar	1,550	$615.3	1,618	554	997	3,169
Storage	360	$218.3	869	323	437	1,629
Total	**4,740**	**$1,706.4**	**4,800**	**1,657**	**2,939**	**9,396**

Table 6 details the OpEx cost and job impacts of the RMI CEP portfolio, and we treat these jobs as long-term jobs. As shown, the RMI CEP portfolio would create/support 879 direct and 1,709 total long-term jobs.

Table 6: Long-term job impacts of RMI's Clean Energy Plan portfolio

Resource	Capacity	OpEx ($M)	Direct	Indirect	Induced	Total jobs
Energy efficiency	550					
Residential	177	$0.0	-	-	-	-
Commercial	201	$0.0	-	-	-	-
Industrial	171	$0.0	-	-	-	-
Winter DR	90	$0.0	n/a	n/a	n/a	n/a
DER Solar	1,450	$0.0	n/a	n/a	n/a	n/a
Onshore wind	600	$169.3	232	69	142	444
Midwest wind	140	$42.3	58	17	36	111
Utility-scale solar	1,550	$224.1	589	202	363	1,154
Storage	360	$0.0	-	-	-	-
Total	**4,740**	**$435.7**	**879**	**288**	**541**	**1,709**

We reproduced this detailed analysis for each of the other two CEP portfolio alternatives. The summary results of our job impacts analysis are provided in Table 7 below. As shown in the table the three CEP alternatives would create and/or support an average of 4,642 direct short-term jobs and 765 long-term jobs, which is 4.6 times more short-term direct jobs and 20 to 30 times more long-term jobs than what TVA has estimated for the NGCC plant and associated pipeline in its preferred Alternative A.

In total, including indirect and induced impacts, the CEP alternatives would create and/or support an average of more than 9,000 short-term jobs and nearly 1,500 long-term jobs. TVA does not provide estimates of indirect and induced job impacts from the proposed Alternative A.

Table 7: Short- and long-term jobs impact of three Clean Energy Portfolio alternatives as compared to TVA's Alternative A

	SACE	RMI	Sierra	CEP Average	TVA Alt. A
Direct jobs					
Short-term	4,800	5,291	3,835	**4,642**	1,000
Long-term	879	783	631	**765**	25-35
Total jobs					
Short-term	9,396	10,513	7,374	**9,094**	n/a
Long-term	1,709	1,534	1,226	**1,490**	n/a

Results of the TVA Energy Efficiency Analysis

Overview

As described, the purpose of the region-wide analysis is to estimate the number of direct, indirect and induced jobs that would be created or sustained on an annual basis by utility and utility-supported customer investments in residential, commercial and industrial energy efficiency in the TVA footprint under two scenarios: (1) an annual energy efficiency target of one percent of prior-year retail sales, and (2) an annual target of three percent of prior year retail sales. The time period of analysis runs from 2022 through 2035, to coincide with President Biden's goal of 100 percent carbon-free energy nationwide by 2035.

The analysis consists of three steps for each of the two scenarios: (1) estimate the annual energy savings required to achieve the target, for each sector; (2) Use LBNL's total cost of saved energy values for each sector to generate sector-specific annual energy efficiency investments; and, (3) input those investment models into IMPLAN to generate the estimated annual direct, indirect and induced job impacts that would result.

Energy Savings

The baseline (2021) value for retail electricity sales from TVA is 145,727,929 megawatt-hours (MWh). As shown in Table 8, an annual target of one percent electricity savings below prior year retail sales would save nearly 1.4 million MWh, on average from 2022 through 2035. The residential sector would account for, and benefit from, approximately 40% of those annual savings, followed by the commercial sector at 32% and the industrial sector at 28%. Over the 14-year period, total electricity savings would amount to more than 19.1 million MWh.

Table 8: Annual electricity savings in select years from a 1% energy efficiency target

1% savings per year	2022	2025	2030	2035	14-year average
Residential	585,063	567,686	539,864	513,405	548,514
Commercial	471,179	457,184	434,778	413,469	441,744
Industrial	401,038	389,127	370,056	351,919	375,985
Total	**1,457,279**	**1,413,997**	**1,344,697**	**1,278,793**	**1,366,243**

Table 9 shows the annual savings in select years that would be achieved with an annual target of three percent electricity savings below prior year retail sales. This scenario would achieve an average annual savings of more than 3.6 million MWh. The percent of total savings by sector would be the same as for the one percent scenario. Over the 14-year period, total electricity savings would amount to nearly 50.6 million MWh.

Table 9: Annual electricity savings in select years from a 3% energy efficiency target

3% savings/ year	2022	2025	2030	2035	14-year average
Residential	1,755,188	1,601,913	1,375,617	1,181,289	1,450,804
Commercial	1,413,536	1,290,096	1,107,850	951,348	1,168,401
Industrial	1,203,113	1,098,049	942,932	809,728	994,470
Total	**4,371,838**	**3,990,058**	**3,426,399**	**2,942,365**	**3,613,675**

Annual Energy Efficiency Investments

To generate an annual total utility and customer investment value required to achieve the one percent and three percent annual savings goals we multiplied the annual energy savings for each sector by the total cost of saved energy (for each sector) as reported by LBNL and provided in Table 2.

The results for total annual energy efficiency investments for the one percent scenario are provided in Table 10. As shown, this scenario would require an average annual investment of approximately $66.4 million dollars, with 32 percent of that investment being in the residential sector, 37 percent in the commercial sector and 31% in the industrial sector. Over the 14-year period total investment would amount to nearly $930 million.

Table 10: Annual energy efficiency investment in select years to achieve a 1% energy efficiency target (in million dollars)

Sector/year	2022	2025	2030	2035	14-year average
Residential	$22.8	$22.1	$21.0	$20.0	$21.4
Commercial	$25.9	$25.1	$23.9	$22.7	$24.3
Industrial	$22.1	$21.4	$20.4	$19.4	$20.7
Total	**$70.8**	**$68.7**	**$65.3**	**$62.1**	**$66.4**

The results for total annual energy efficiency investments for the three percent scenario are provided in Table 11. As shown, this scenario would require an average annual investment of approximately $175.5 million dollars, again with 32 percent of that investment being in the residential sector, 37 percent in the commercial sector and 31% in the industrial sector. Over the 14-year period total investment would amount to nearly $2.5 billion.

Table 11: Annual energy efficiency investment in select years to achieve a 3% energy efficiency target (in million dollars)

Sector/year	2022	2025	2030	2035	14-year average
Residential	$68.5	$62.5	$53.6	$46.1	$56.6
Commercial	$77.7	$71.0	$60.9	$52.3	$64.3
Industrial	$66.2	$60.4	$51.9	$44.5	$54.7
Total	**$212.4**	**$193.8**	**$166.4**	**$142.9**	**$175.5**

Job Creation

As explained in the Methodology section, to generate an estimate for the number of direct, indirect and induced jobs that would result from the one percent and three percent energy efficiency scenarios, we input annual investment values for the residential, commercial and industrial sector into IMPLAN. For the residential sector, the investment input was broken out by specific improvements and upgrades to generate a more accurate jobs impact. Sufficient data was not available from utility reports to do the same for the commercial and industrial sectors.

The methodology section also defines direct, indirect and induced effects in terms of jobs. However there is another layer underlying the results for job impacts. Energy efficiency investments create jobs in two ways: (1) through the **implementation** of the efficiency improvements, and (2) through the **expenditure of savings** on electric bills as a result of the efficiency improvements. Jobs are also lost in two ways: (1) through **higher rates** because utilities charge ratepayers for the efficiency programs, which offsets *a portion of* the bill savings from the efficiency improvements, and (2) as a result of **lost revenue for the utilities** due to decreased electricity sales, which could ultimately lead to reduced payrolls at those utilities. However, as the tables below show, our analysis found that the net impact on jobs from both of the efficiency scenarios is strongly positive.

Table 12 details the results of the jobs analysis for **direct jobs**, and serves as an example of how the four aspects of job impacts explained above (implementation, etc) serve to produce a net annual jobs impact. As shown in the table, the **implementation** of energy efficiency measures creates and/or supports an average of 344 annual direct jobs over the 14-year modeling period, while the expenditure of **gross bill savings** realized from the efficiency improvements results in an average of 2,435 new annual jobs. Those bill savings are offset by the cost of the efficiency measures for customers (**customer cost**), expressed through increased rates, which amounts to an average annual job “loss” of 192 jobs, while **lost utility revenue** results in an average annual loss of 696 jobs.

Overall, efficiency investments that achieve an annual 1% reduction in electricity sales would produce a net average annual gain of 1,892 direct jobs from 2022 through 2035. In 2035 the net gain would amount to 3,321 direct jobs.

Table 12: Calculation of net impact on direct jobs created/supported by energy efficiency investments (using the 1% scenario as an example)

Direct jobs	2022	2025	2030	2035	14-year average
Implementation	367	356	339	322	344
Gross savings	339	1,336	2,932	4,449	2,435
Customer cost	(205)	(199)	(189)	(180)	(192)
Utility losses	(97)	(381)	(837)	(1,271)	(696)
Total job gains	706	1,692	3,270	4,771	2,780
Total job losses	(302)	(580)	(1,026)	(1,450)	(888)
Net jobs impact	**405**	**1,112**	**2,244**	**3,321**	**1,892**

As shown in Table 13, this net impact is much greater when indirect and induced effects are included. The net impact on the combination of direct, indirect and induced jobs would be 926 net jobs gained in 2022, rising to 10,738 jobs for the year 2035, for an average annual net gain of 5,930 total jobs over the modeling period.

Table 13: Annual net jobs produced (total of direct, indirect and induced jobs) from achieving a 1% energy savings target from 2022 through 2035

Total jobs	2022	2025	2030	2035	14-year average
Implementation	725	704	669	636	680
Gross savings	1,126	4,437	9,738	14,779	8,090
Customer cost	(609)	(591)	(562)	(535)	(571)
Utility losses	(316)	(1,244)	(2,730)	(4,143)	(2,268)
Total job gains	1,851	5,140	10,407	15,415	8,769
Total job losses	(925)	(1,835)	(3,292)	(4,677)	(2,839)
Net jobs impact	**926**	**3,305**	**7,115**	**10,738**	**5,930**

With a more aggressive target of three percent annual savings below prior year retail sales the job impacts would be much greater. As shown in Table 14, a three percent annual target would result in a net jobs impact of 2,778 jobs in 2022 and 28,366 jobs in 2035, for an average annual net impact of 16,349 jobs created or supported over the 14-year modeling period.

Table 14: Annual net jobs produced (total of direct, indirect and induced jobs) from achieving a 3% energy savings target from 2022 through 2035

Total jobs	2022	2025	2030	2035	14-year average
Implementation	2,175	1,985	1,705	1,464	1,798
Gross savings	3,378	12,916	26,997	39,090	22,319
Customer cost	(1,828)	(1,669)	(1,433)	(1,230)	(1,511)
Utility losses	(947)	(3,620)	(7,568)	(10,957)	(6,256)
Total job gains	5,553	14,901	28,702	40,554	24,117
Total job losses	(2,775)	(5,289)	(9,000)	(12,188)	(7,767)
Net jobs impact	**2,778**	**9,612**	**19,702**	**28,366**	**16,349**

Finally, Table 15 details the number of net jobs created or supported by energy efficiency investments would nearly triple under the three percent scenario compared to the one percent scenario. Additionally, the largest category of jobs created in 2035 and on average over the modeling period would be induced jobs – those jobs resulting from people and businesses spending their energy savings on other goods and services. This is to be expected since the savings accumulate over time whereas direct efficiency investments decline. However, the direct jobs (implementation labor) and indirect jobs (jobs resulting from the purchase of products and appliances for implementation) combined represent approximately half of the net jobs created in 2035 and on average over the modeling period.

Table 15: Comparison of net direct, indirect and induced annual jobs resulting from a 1% and 3% annual energy savings target

	2022		2035		14-year average	
	1% scenario	3% scenario	1% scenario	3% scenario	1% scenario	3% scenario
Direct	405	1,214	3,321	8,735	1,892	5,203
Indirect	183	549	1,672	4,403	942	2,593
Induced	338	1,015	5,745	15,228	3,096	8,553
Total	**926**	**2,778**	**10,738**	**28,366**	**5,930**	**16,349**

The jobs created or supported from energy efficiency investments in any given year are specific to that year only. For instance, because the annual energy savings and thus investments decline each year from 2022 through 2035 – as a result of "prior year sales" declining due to efficiency improvements – the number of jobs created/supported by the **implementation** of energy efficiency measures thereby also declines. This is because a job a person has retrofitting a home or business is a one-time job, and further investments are required to sustain that job in subsequent years. On the other hand, jobs created or supported because people are **saving money** on their electric bills are sustained over time because those savings are realized every year, and as cumulative savings increase, so do the jobs resulting from the expenditure of those savings. Similarly, jobs lost because the utility is losing revenue are also sustained as cumulative electricity savings increases and annual utility revenue continues to decrease. However, overall, the number of net annual jobs resulting from both a one and three percent annual savings increase over time even as annual savings and investment values decline.

Conclusion

This comment evaluates the job creation potential from three CEP scenarios that demonstrate how energy efficiency, renewable energy, and battery storage resources can be deployed to replace capacity from the Cumberland fossil plant. These different scenarios would each create a significant number of both short- and long-term jobs through sustained investment in clean energy in line with the mandates of the Biden Administration. We understand TVA's commitment to methane gas in Alternatives A and B to be a missed opportunity and an inappropriate and short-sighted use of customer funding. At least two of the three CEP scenarios detailed here are cost competitive with a new NGCC plant and represent critical investments in a clean energy future. While a comprehensive assessment of the socio-economic, environmental, and climate impacts of a CEP are outside the scope of this analysis, we demonstrate net job creation across the region as a result of a CEP scenario including EE.

Achieving these outcomes that ensure a just transition for Tennessee Valley residents means that clean energy should receive equal and adequate consideration from TVA, but that was not done in the DEIS. A job creation analysis was missing from the only clean energy alternative provided (Alternative C) and low-cost resources, including EE were not included.

Based on a comprehensive analysis, Appalachian Voices finds that

1. TVA should examine the ability of energy efficiency and demand response to reduce the amount of replacement generation needed at Cumberland and other sites and to maximize the beneficial jobs impact on the Tennessee Valley region as a whole.
2. A Clean Energy Portfolio is a reasonable alternative for replacing the capacity at the Cumberland Fossil Plant and would generate tremendous employment benefits for the region. TVA should conduct a *full* environmental review under NEPA that includes a CEP alternative for Cumberland.
3. TVA should select a carbon free energy alternative for replacing the capacity at the Cumberland Fossil Plant to meet the climate, equity, and clean energy goals of the Biden Administration and avoid building out new gas generation as proposed in Alternatives A and B.

Prioritizing clean energy resources can meet TVA's generation needs to ensure reliable and cost-effective electricity supply. A CEP has the added benefits of creating jobs, potentially lowering energy bills and reducing energy burden for residents and businesses, attracting investment, advancing economic development in the Tennessee Valley, and achieving a central pillar of TVA's mission to steward the region's land and water.