1.866.522.SACE
www.cleanenergy.org
P.O. Box 1842
Knoxville, TN 37901
865.637.6055
46 Orchard Street
Asheville, NC 28801

April 8, 2019

Hunter Hydas, Enterprise Planning
Amy Henry, Enterprise Relations + Innovation
Ashley Pilakowski, NEPA Project Manager
Tennessee Valley Authority
400 W. Summit Hill Dr.
Knoxville, TN 37902

Re: SACE Comments on 2019 Draft Integrated Resource Plan and Environmental Impact Statement

Dear Mr. Hydas, Ms. Henry, and Ms. Pilakowski,

The Southern Alliance for Clean Energy (SACE) was involved in the Tennessee Valley Authority's (TVA's) two previous Integrated Resource Plans (IRP) in 2011 and 2015. The process to develop this Draft 2019 IRP has been markedly opaque and biased. We have little trust that this comment process will have any meaningful impact on the future of electricity in the Tennessee Valley, however because TVA is an unregulated monopoly we have no other option except to submit these comments on the Draft IRP and Environmental Impact Statement.

The process may appear transparent and objective to a layperson, but when we dug into the Integrated Resource Plan (IRP) and Environmental Impact Statement (EIS), what we found led us to believe that TVA drove processes and assumptions toward a specific set of preselected outcomes, as laid out here. We submit these comments on key areas for improvement, without which the TVA Board of Directors should not approve a final IRP and EIS.

SACE has been a leading voice for smart and responsible energy policies to protect the quality of life and treasured places in the Southeast since 1985. SACE staff were involved in the 2011 and 2015 IRP processes as members of the 2011 IRP Stakeholder Review Group and the 2015 IRP Working Group, Energy Efficiency Information Exchange, Tennessee Valley

Renewable Information Exchange, and remain a member of the Regional Energy Resource Council, a formal advisory committee to TVA's Board of Directors.

Resource planning is an important process for electric utilities to look forward at ways to address sectoral changes and reorient themselves toward their goals of providing safe and reliable power at the lowest cost to all customers. We recognize that the IRP process is time and resource intensive, and appreciate that TVA is investing in this important process. However, there are substantial gaps between IRP best practices and this TVA process.

In the Draft 2019 IRP, TVA has constrained the potential portfolios to fit within its existing operating model. TVA has not explored the full range of options in order to optimize for what is best for TVA customers. Why undertake the future planning process at all? We call on TVA to make fundamental changes to its current Draft 2019 IRP to prioritize low system costs, and thus low customer bills, to objectively evaluate options without imposing preferential treatment, and to operate in a transparent and inclusive manner.

Transparency and Collaboration

IRP processes should be transparent and involve stakeholders throughout the process. In its 2015 IRP TVA worked with stakeholders and industry experts to provide TVA with current data related to performance and costs for both renewable energy and energy efficiency resources. For the 2019 IRP process TVA benchmarked its supply-side resource assumptions behind closed doors, and does not appear to have sought stakeholder input or industry expertise on demand-side resource assumptions.

The Draft 2019 IRP lacked key details and data to allow for informed public scrutiny as required by both the TVA Act and the National Environmental Policy Act (NEPA). After attempting to complete comments based on TVA's initial, inadequate, disclosure, SACE requested some of this information from TVA on March 21. TVA delivered what can be charitably described as a partial disclosure via a Freedom of Information Act (FOIA) request late in the day on April 3. That left a little over 3 business days for stakeholders to review these new documents and integrate any findings into comments. This was wholly inadequate, particularly in light of the TVA's evident failure to provide full documentation.

Energy Efficiency

A successful IRP seeks to minimize total system costs without limiting customer choice, thus leading to the lowest possible customer costs. The TVA Act is clear that TVA's resource planning process must aim for the lowest system cost and evaluate supply-side and demand-side resources on equal footing. The Act states that "the term "system cost" means all direct and quantifiable net costs for an energy resource over its available life, including the cost of production, transportation, utilization, waste management, environmental compliance, and, in the case of imported energy resources, maintaining access to foreign sources of supply."[1]

Customers do not pay an energy rate; they pay a bill. TVA's failure to invest in energy efficiency will increase utility system costs and exacerbate the ongoing issue of high customer bills issues throughout the Tennessee Valley. Ultimately, TVA's failure to include meaningful energy efficiency program investments in its resource portfolio mix will lead to unnecessarily higher customer bills. To be serious about doing what is best for residents of the Tennessee Valley, TVA must remove arbitrary constraints and use realistic cost figures for energy efficiency in its IRP.

Objective Evaluation

A successful IRP evaluates the entire life-cycle cost of all resources, both supply and demand, and both existing and potential. The analysis in the Draft 2019 IRP appears to drive the results away from renewables and energy efficiency in preference to building new gas generation. TVA may even be laying the foundation for costly, risky new nuclear generation by using very low, unsubstantiated cost estimates and, even though found wholly uneconomic at that cost, forcing it in one case. TVA demonstrates apparent bias in the Draft 2019 IRP by utilizing high cost estimates for solar, wind, storage, and energy efficiency, but low cost estimates for gas and nuclear resources.

Despite attempts by TVA to skew the results away from solar, the resource is too attractive to suppress completely. Most of the IRP cases hit TVA-imposed constraints on solar installations in every year possible, indicating that these portfolios are leaving economic solar on the table. TVA ran sensitivities on the Current Outlook Scenario, Base Case Strategy

[1] U.S. Code Title 16, Chapter 12A, §831m-1(b)(3)

to observe what happens when these constraints are doubled or removed. However, this case was not one of the cases where the model hit up against the annual solar cap in each year possible, so the results of these sensitivities are not as helpful as they would appear. Even so, under this case the unconstrained model chooses more solar than it did with the constraints. Unfortunately wind and energy efficiency fell victim to TVA's unreasonable assumptions and constraints.

Regulatory Oversight

A successful IRP should be overseen by an engaged regulatory body. We call on the TVA Board of Directors to reject the 2019 IRP unless TVA makes serious strides in the areas highlighted above and described in detail in our comments.

Sincerely,

Stephen Smith

Executive Director

Southern Alliance for Clean Energy Comments on Tennessee Valley Authority Draft 2019 Integrated Resource Plan and Environmental Impact Statement

Table of Contents

1. Transparency and Collaboration

IRP processes should be transparent and involve stakeholders throughout the process. In its 2015 IRP TVA worked with stakeholders and industry experts to provide TVA with current data related to performance and costs for both renewable energy and energy efficiency resources. For the 2019 IRP process TVA benchmarked its supply-side resource assumptions behind closed doors, and does not appear to have sought stakeholder input or industry expertise on demand-side resource assumptions.

1.1 TVA Should Release Data and Documentation with IRP

Multiple stakeholder organizations, including SACE, requested additional documentation and records used in the Draft 2019 IRP. The National Environmental Policy Act (NEPA) requires that TVA perform an Environmental Impact Statement (EIS) for its IRP. NEPA's implementing regulations mandate that TVA "shall to the fullest extent possible . . . [e]ncourage and facilitate public involvement."[2] To accomplish that objective, the regulations require that "environmental information [be] available to public officials and citizens before decisions are made and before actions are taken" so that "public officials make decisions that are based on understanding of environmental consequences."[3] Moreover, while TVA is permitted to "incorporate material" into its EIS, the regulations mandate that any such incorporated material must be "reasonably available for inspection by potentially interested persons within the time allowed for comment," and that any "[m]aterial based on proprietary data which is itself not available for review and comment shall not be incorporated by reference."[4]

NEPA also states that any materials on which an EIS relies must be made "available for inspection by potentially interested persons within the time allowed for comment." TVA sent most requested documents directly to requesting organizations, instead of publishing them on the IRP website, and refused to extend comment period to allow more than three business days to review over 60 new documents.

In addition, the documentation and data shared with SACE was still incomplete. Several spreadsheets had key data missing, and TVA has yet to provide three studies on which key assumptions in the IRP are based: the Reserve Margin study, the Intermittent Resources Study, and the Flexibility Study. SACE has participated in review of IRPs in several other states. Some of the questions we were unable to evaluate in our review that are of critical importance include:

- What assumptions and methods TVA used in order to create stochastic models of loads during rare and very cold events? Typically, the winter reserve margin results generated by Astrape are highly sensitive to the utility's assumptions

[2] U.S. Code Title 40, Chapter 5, §1500.2

[3] Id. §1500.1(b)(c)

[4] Id. § 1502.21

about the relationship between very cold conditions and load. Such assumptions should be validated by studies of end user load trends. Was the winter peak load analysis reviewed by Navigant and the stakeholder working group? If so, what was the feedback?

- What assumptions and methods were used to project large customer loads? TVA provided no detail regarding the "industry analyses and feedback from large, directly served customers" that it relied on for its load forecast. The brief explanation in Section 4.1.1.1 of the Draft IRP emphasizes a discussion of national "economic conditions impacting the demand for manufactured goods." There is literally no discussion of any regional trends (growth or decline) in specific industrial activities. Furthermore, there is no discussion of data centers, which have been locating in TVA territory in association with solar development projects. Was the large customer load forecast reviewed by Navigant and the stakeholder working group? If so, what was the feedback?
- What assumptions were made regarding future fixed operating and maintenance costs, and future capital investment costs, for existing assets? Section 5.2.1 provides no information about this topic, which is essential to understanding whether the consideration of plant retirements and license expirations were adequately studied. Were there any "must run" model requirements that could have affected these decision? Are coal units being forced into operation as virtual peaking plants? If so, what assumptions are being made about such operation on the operating and maintenance costs associated with frequent cycling? If these costs were included in the model, where they reviewed by Navigant and the stakeholder working group? If so, what was the feedback?
- What reliability metrics were imposed in the flexibility, integration, and reserve margin studies? We reviewed the available material and found no discussion of this important topic. For example, it is unclear if Astrape's SERVM model is defaulted to allow carrying capacity to be released for short duration during contingency events (as NERC requirements allow), or if it requires carrying capacity to be maintained during all events. Did TVA set reliability metrics in these studies based on loss of load expectation (or equivalent)? While appropriate for a long-term planning of reserve capacity, such a standard is inappropriate, unnecessary, and not required by NERC standards. If TVA used such a standard in actual operations, it would result in an excessively expensive outcome. Accordingly, this would be wholly inappropriate to use in a planning study. Were TVA's reliability metrics and methods associated with studying ancillary charges reviewed by Navigant and the stakeholder working group? If so, what was the feedback?
- When studying flexibility, integration, and reserve margin, was TVA evaluated as an "island," requiring continuous balancing based on load? In fact, NERC balancing requirements only require TVA to take action when ACE drives the power system frequency away from 60 Hz – and actually give credit for generation/load imbalances when they are helping to restore the system to 60

Hz. Methods used by Astrape in other Southeastern states result in excessive requirements, but more appropriate methods are available.[5] Was TVA's assumption regarding balancing requirements in studying ancillary charges reviewed by Navigant and the stakeholder working group? If so, what was the feedback?

- In response to our FOIA request for data used in the flexibility, integration and reserve margin studies, TVA provided the solar data that SACE and CPR supplied TVA in 2014. The data for these 26 sites covers the years 1998-2013, which is 16 years of data.
    - According to section D.2.3 of the Draft Report, the reserve margin study utilized 37 years of weather data. The data supplied in response to the FOIA request include 35, not 37, years of temperature data. Appendix D includes no clear statement on what solar data were utilized for the reserve margin study, or how those data were aligned with the weather data. The data supplied in response to the FOIA request suggest that while 26 sites were averaged for fixed mount systems, data for Memphis alone were used for tracking systems. None of these solar data covered 37 years. No wind data were supplied in response to the FOIA request. Either TVA has not conducted a reserve margin study using 37 years of weather-aligned renewable energy data, or the FOIA response supplied the wrong data. It would not be possible to use the 15-year CPR dataset to load match with 35 (or 37) years of load and weather data and generate appropriate stochastic results. As best we can conclude, if these are the correct data, then TVA has not applied a proper stochastic analysis of renewable energy production in the reserve margin study and many of its results are likely to be fundamentally flawed.
    - According to sections D.3.3 and D.4.1 of the Draft IRP, the intermittent resources and flexibility studies evaluated sub-hourly integration costs. It would not be possible to use the hourly CPR or 3tier datasets to create sub-hourly solar and wind resource production. Furthermore, the data supplied by TVA in the FOIA response includes 35 years of simulated wind data from 3tier, and 1 aggregate solar profile with 9 levels of cloud cover. None of the documentation provided by TVA explain how the 8760x9 solar profile relates to 35 years of solar data, nor how it is related to historical load and weather data which were not supplied for the intermittent resource study. The documentation supplied for the flexibility study does not include any information related to solar or wind data, so it is unclear what application (if any) of these solar generation patterns were applied for this study. As best we can conclude, if these are the correct data, then TVA has not applied a proper stochastic analysis of renewable energy

[5] Idaho Power, *Solar Integration Study Report* (April 2016).

production in the intermittent resources and flexibility studies and many of its results are likely to be fundamentally flawed.

TVA should release all documents and data used in its IRP and EIS and allow the public an additional comment period. For future IRPs, TVA should release all studies and the data behind each figure in the IRP when it releases the draft IRP to allow stakeholders to provide informed comments in a timely fashion.

1.1 Decarbonization Scenario should go to net zero CO_2 emissions and reflect realistic economic assumptions

TVA should amend the Decarbonization Scenario to study a path towards achieving net zero emissions by the 2040-2050 timeframe. This goal is based on reports from the scientific community and policy proposals and has already been adopted by several large electric utilities such as Xcel Energy and Southern Company. These reports also deem the electricity sector to be one of the easier to decarbonize, so the sector is expected to decarbonize faster than the overall economy. This expectation exists not only among the scientific community, but also among investor groups. Earlier in 2019, a group of investors and pension funds sent a letter to the top 20 largest publicly traded electric generators in the United States asking for detailed plans to achieve carbon-free electricity by 2050 at the latest.

Under the Base Case Strategy, the Decarbonization Scenario still has 30-31 MMTons of CO_2 and 5% and 19% of energy from coal and gas, respectively, in 2038. This generally appears to assume that coal will be replaced with gas, but SACE would note that this is a process that is already under way in the U.S. electric power market, and therefore does not represent a significant decarbonization effort. Decarbonization requires technology shifts that cannot be represented by replacing coal with gas. TVA should revise its Decarbonization Scenario to require net zero emissions by a specified year in the 2040-2050 timeframe. Even if that year is outside of the IRP framework, TVA would need to be on a trajectory toward net zero emissions in 2038, to meet goals in the 2040-2050 range.

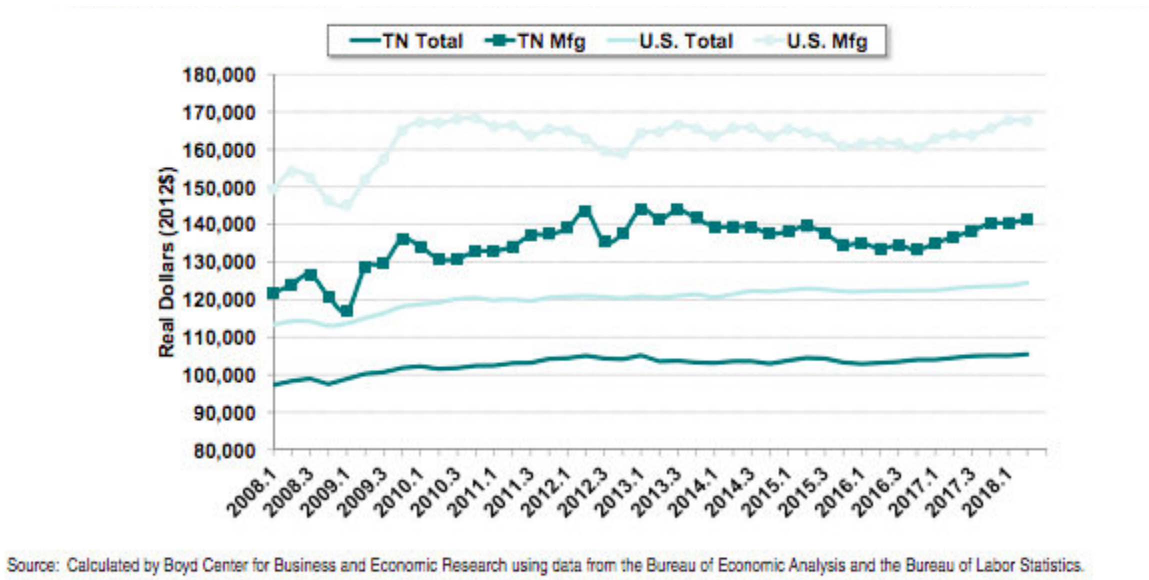
In its discussion of the proposed Decarbonization Scenario, TVA assumes that decarbonization policies will reduce economic growth. SACE requested documentation TVA used to come up with this assumption in our document request under NEPA and FOIA. TVA's response stated the following.

> *"The Decarbonization scenario represents a plausible future in which a CO_2 emission penalty is applied to the utility industry in an effort to curb greenhouse gas emissions. A CO_2 penalty would very likely result in an increase in natural gas units, and consequently demand for natural gas, as higher CO_2 emitting plants such as those fired by coal become uneconomic. Demand and price for natural gas would rise, leading to an increase in electricity prices. Based on information from the US Bureau of Economic Analysis, US Bureau of Labor Statistics, and US Energy*

Information Agency, there is an inverse correlation between the real price of electricity and labor productivity. Please see related posted information for a comparison of U.S. Labor Productivity vs. Price of Electricity."

TVA's response claims there is an inverse correlation between the real price of electricity and labor productivity. However, this claim is incomplete and misleading. Changes in labor productivity *per hour* do not have a significant impact on overall labor productivity or economic output per worker. In an annual economic report to the Governor of the State of Tennessee, the University of Tennessee Knoxville (UTK) showed flat GDP output per worker in the state, as illustrated in Figure 1.

Figure 1. Real GDP per Worker Has Shown Weak Gains Since the Great Recession



Source: Boyd Center for Business and Economic Research, Haslam College of Business, University of Tennessee, Knoxville, An Economic Report to the Governor of the State of Tennessee, January 2019. Available at: http://cber.haslam.utk.edu/erg/erg2019.pdf

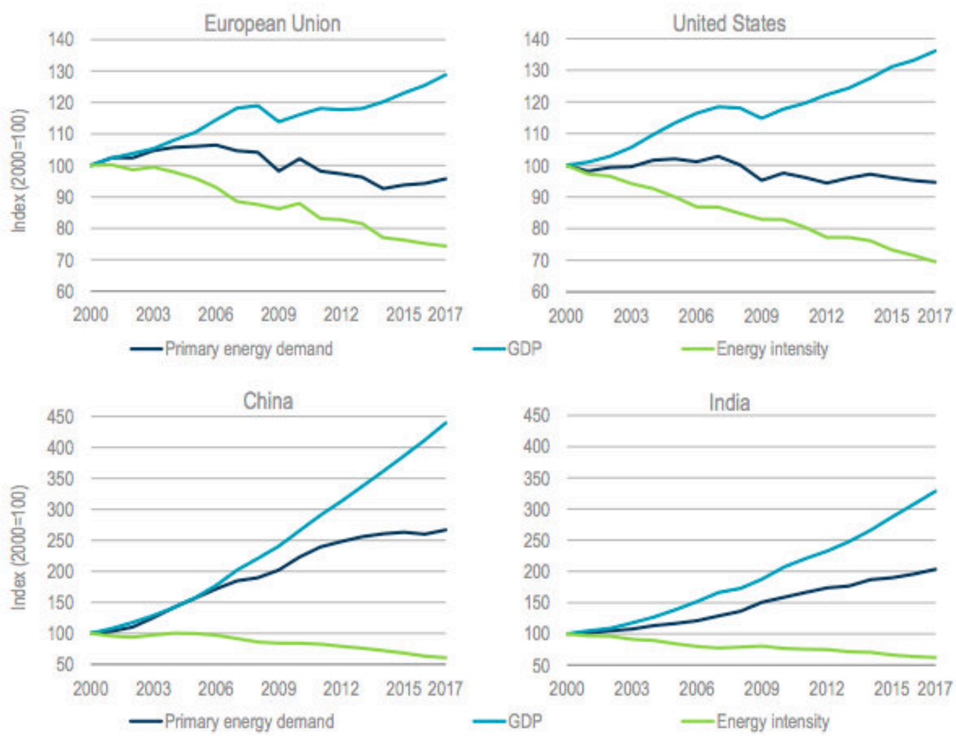
The trends and small gains in labor productivity per hour on the national scale cited by TVA have likely had a negligible impact on how the labor force make contributions to the regional economy in the Tennessee Valley. UTK notes several explanations of the overall low productivity in the state: "There is still no consensus on why productivity has become so sluggish. One explanation is diminished marginal gains from the computer revolution. The service sector generally suffers from relatively weak gains in productivity, and its rise has been another one of the factors contributing to slower overall productivity growth."[6]

[6] Boyd Center for Business and Economic Research, Haslam College of Business, University of Tennessee, Knoxville, *An Economic Report to the Governor of the State of Tennessee*, January 2019. Available at: http://cber.haslam.utk.edu/erg/erg2019.pdf.

Moreover, U.S. GDP continues to grow with declining energy usage. This indicates that the industries contributing to GDP growth do not require significant energy to produce economic output. Therefore, it is unlikely that long-term trends in electricity prices, within a reasonable range, will have a discernible impact on economic output.

The relationship between energy use and economic output is illustrated by looking at energy demand, gross domestic product (GDP), and energy intensity indexed to 2000 levels. "The movement of economic activity away from energy-intensive heavy industries toward less energy-intensive service sectors" was noted by the International Energy Agency (IEA) as a primary reason for this trend in its most recent market series report on energy efficiency.[7] This strongly mirrors UTK's observations about reliance on service sectors for economic growth.

Figure 2. Primary Energy Demand, GDP, Energy Intensity in Selected Economies, 2000-2017



Source: IEA, Market Report Series: Energy Efficiency 2018

TVA's Decarbonization scenario claims that curbing greenhouse gas (GHG) emissions will make the US less competitive globally. However, as evidenced above, countries have dramatically increased GDP growth during the past two decades, and have done so with less energy-intensive economies. Unchecked GHG emissions disincentivizes energy efficiency, which then promotes energy to be used in a way that makes minimal contributions to the economy. Ultimately, the GHG policies in the Decarbonization

---

[7] IEA, *Market Report Series: Energy Efficiency 2018*, Available at: https://webstore.iea.org/market-report-series-energy-efficiency-2018.

scenario would have a negligible impact on US global competitiveness. **TVA should remove this assumption from the Decarbonization scenario before finalizing the IRP.**

The TVA staff should also consider whether additional costs for new fossil plants of any kind, including gas, will be likely to have higher overnight costs driven by stricter permitting regulations.

2. Objective Evaluation

TVA's modeling to develop the IRP portfolios clearly impose arbitrary constraints on implementation of key clean energy resources, particularly energy efficiency. However, TVA has failed to provide sufficient information to stakeholders such that we can provide informed comments. TVA has chosen the future portfolio that best fits within its current operating model, adding more and more fossil and nuclear generation regardless of whether or not they are the most cost-effective and appropriate resources for TVA customers. TVA is being opaque about limits placed on energy efficiency and solar in the IRP in what appears to be an attempt to avoid criticism for failing to transition into a utility of the future. The following comments outline changes TVA should make to objectively evaluate demand- and supply-side resources before finalizing the 2019 IRP.

2.1 Demand-side resource assumptions

2.1.1 TVA should not impose arbitrary constraints on cost-effective energy efficiency

TVA downplays the role of energy efficiency resources, particularly for residential customers, in large part by claiming that natural adoption rates of energy efficiency eliminate the potential for TVA LPCs to capture additional cost-effective savings though utility efficiency programs. This premise is based on changes in federal standards and local codes (as stated in the Draft IRP sections 7-9 and 7-11). TVA's assertion that its energy efficiency potential is eroded by codes and standards does not stand up to scrutiny.

- TVA made this assertion without appearing to examine any empirical evidence on market penetration and saturation rates for the existing housing stock.
- TVA's assertion is easily countered by the real world experiences of regular residential customers in the TVA service area who currently pay high energy bills and lack the efficiency measures typically included in utility efficiency programs, including those offered by TVA in the past. In particular, low-income customers in both urban and rural areas struggle to access these improvements. (See customer testimonials below.)

- TVA is out of step with many peers. Despite facing the same dynamics regarding efficiency baseline changes and declining solar prices, major utilities in the region and beyond continue to reap substantial savings from utility efficiency programs.

Fundamentally, it appears that TVA's IRP reaches these flawed conclusions because TVA has failed to focus on efficiency needs in existing buildings and equipment, and because TVA has not considered its role in addressing market transformation opportunities.

Federal standards and local codes are not adequate to drive cost-effective investments in retrofit of buildings, and cost-effective upgrades of existing equipment. Utility energy efficiency programs are essential to help ensure that the benefit to the TVA system is realized when homeowners, businesses, and other customers are making decisions about retrofit or upgrade investments. The benefit to the TVA system can be achieved through rebates, education (customer awareness), or technical assistance services (audits or other decision-making tools). TVA's failure to commit to expanding such programs will reduce overall system benefits and result in higher customer bills.

Many utilities across the country with long running, successful efficiency programs have faced the same upward pressure on baselines from changing codes and standards, yet continue to deliver large amounts of cost effective energy savings year after year. Technological improvement does not necessarily erode the potential for utility energy efficiency program savings, but in fact can open up opportunities for additional efficiency opportunities. For example, a decade ago lighting programs focused on replacing incandescent bulbs with compact fluorescent bulbs. Since then, technology improvement has continued with LED bulbs now the most efficient option, opening up additional potential for savings. Baseline changes due to increased codes and standards are not new, nor are they a legitimate excuse for TVA to halt investment in energy efficiency.

Furthermore, TVA is failing to recognize its role as a market transformation agent. Without TVA helping to drive customer adoption of new technologies, TVA's customers will remain behind other regions of the country, missing out on economic development opportunities. As described by the Northwest Power and Conservation Council (NPCC), "Utility efficiency programs build on the existing baseline for each measure and incentivize consumer selections toward higher efficiency devices (Pull Effect). Federal and state standards, on the other hand, push for increasing the minimum efficiency of the devices. Combination of the two strategies pushes the low efficiency measures out and helps pull-in higher efficiency measures."[8]

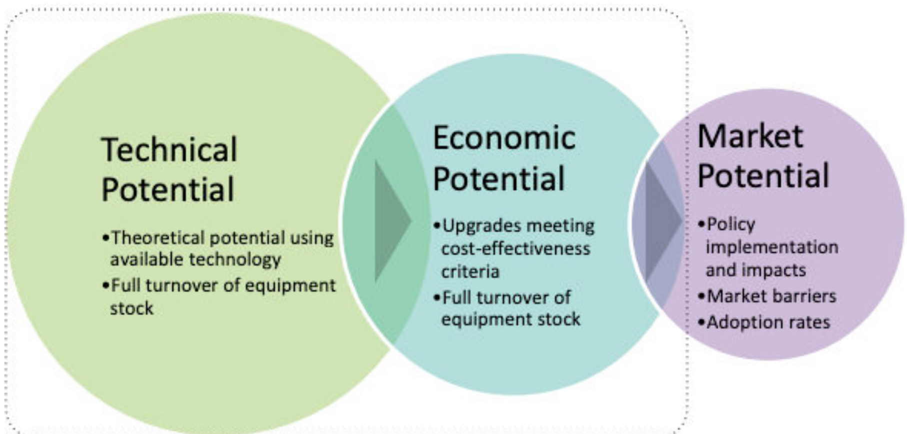
[8] Northwest Power and Conservation Council, Seventh Power Plan, Appendix F: Effect of Federal Appliance Efficiency Standards, 2016, Available at: https://www.nwcouncil.org/sites/default/files/7thplanfinal_appdixf_impactfederalstands_1.pdf.

2.1.2 TVA should provide empirical evidence on market penetration and saturation rates if it continues using current energy efficiency assumptions

The burden of proof of energy efficiency potential should be on TVA, yet TVA provides no basis in the Draft IRP for their assertion that federal standards and codes have fundamentally undermined the potential for utility energy efficiency in the Valley. Therefore, SACE provides evidence to the contrary of TVA's assumption here and in the following sections.

The Draft IRP appears to limit energy efficiency on an annual and cumulative basis. Information provided to SACE by TVA via a FOIA request implies that residential energy efficiency is capped at 15.71 MW, though it is unclear whether this cap is annual or cumulative. Either way this cap is incredibly small.

Figure 3. Overview of Layers of Energy Efficiency Potential



Source: Wilson, E., et al. Energy Efficiency Potential in the U.S. Single-Family Housing Stock. *NREL/TP-5500-68670, 2017.*

The Draft IRP provides no information on assumed energy efficiency potential. SACE estimates from data provided by TVA in response to our FOIA request that TVA capped overall energy efficiency savings at 842 GWh across its entire service territory through 2038 for all sectors. This is orders of magnitude below estimates from industry sources. The Electric Power Research Institute (EPRI) estimated in 2017 that there is 20,676 GWh of economic energy efficiency savings above and beyond energy saved due to standards and codes in Tennessee alone through 2035.[9] Because TVA is claiming to be modeling energy efficiency as a resource, **it should use technical potential to cap overall cumulative energy efficiency and update annual limits on energy efficiency to be reasonable and to escalate as programs mature.** Instead TVA is

[9] State Level Electric Energy Efficiency Potential Estimates: EPRI, Palo Alto, CA: 2017. 3002009988.

capping energy efficiency at level that is less than 3% of the estimated economic potential in TVA through 2035.[10]

One particularly strong opportunity for energy efficiency is with heating, which is primarily electric across the Tennessee Valley. Replacing electric furnaces when they wear out with high-efficiency heat pumps is a huge opportunity for energy efficiency in TVA. The National Renewable Energy Laboratory (NREL) estimates that this one measure alone has the potential to save Tennessee residents *$302.8 million* on utility bills over 30 years.[11]

2.1.3 TVA should recognize the potential to help customers with bills through energy efficiency

Energy efficiency programs fix an underlying flaw in the free market. If you are a homeowner replacing your HVAC, renovating your home, replacing an appliance, or just changing a light bulb, it is unlikely that you know what the lifetime cost of that change will be. Free markets assume perfect information, but information about the true costs of renovations, appliances, and lighting is far from easily accessible and easily understood. Even with perfect information, many TVA customers have the funds today to offset the savings they could see over the lifetime of an energy efficiency program. Utility energy efficiency programs are designed to fix this market flaw because reducing energy waste with cost-effective energy efficiency investments costs less than utility costs for power supply alternatives. Thus utilities that fail to invest in energy efficiency cause another market flaw, higher electric costs passed on to customer bills.

The following direct quotes from TVA customers indicate the market is ripe for energy efficiency investment.

"I live in an old house that doesn't have insulation & cheap windows. My elderly husband & I can't afford to remodel this house and we draw too much social security to get help."
"One person lives in my home. No laundry done there so no dryer use. Element is out of hot water heater so no hot water usage. No heat except heat pump set on 68. It is cold and uncomfortable."
"Live on social security with no measurable savings or retirement I have a mobile home with a jest pump that can't keep up with these frigid temps. Thermostat stays on 65 degrees and I freeze all winter but my bill is $200! Live along and cook very little. How can this be?"
"Last year I had to move because it was so expensive we couldn't afford it. Our last bill was

[10] TVA Economic Potential estimated using state-level potentials for each state and multiplying by the average percent of state load served by TVA in 2016 and 2017 according to data reported by TVA to the U.S. EIA.

[11] NREL Residential Energy Efficiency Potential: Tennessee Fact Sheet, https://resstock.nrel.gov/factsheets/TN.

$400… with the heat turned down in a 2 bedroom! Lights were always off! Ridiculous!”
“Single mom of 4. Bill is roughly a little higher than some because the house is soo old.”
“I’d like incentives to ‘fix’ my home for better power usage and conservation of energy.”
“I’m a parent and my parents are senior citizens that have to pay an outrageous bill because they live in a house built in the 1930s.”
“My house was built in the 1930s so it stays cool all year long. I have to run my central heating and air and plug-in heaters because my house stays cool. I’d love to be able to just use my heating and air with no plug-in heaters.”

2.1.4 Energy efficiency costs were calculated in a non-typical way that greatly overstates risk

TVA modeled energy efficiency measures by calculating a levelized cost of energy (LCOE) for each model-selectable tier, with LCOE levels increasing for higher tiers. We understand through communications with TVA that it discounted both the costs (irrelevant since all are in the first year) and the energy saved at a discount factor of 8%.

TVA’s LCOE calculation is not performed in an industry-standard manner. To defend its calculations TVA provided a screenshot of a presentation given by the DOE Office of Indian Energy in 2015 to calculate the LCOE of wind power. That same presentation goes on to recommend two DOE-developed models for calculating LCOE. Neither of those models discount energy as a part of the LCOE calculations.

To confirm that TVA misunderstood the DOE presentation, SACE reached out to the Office of Indian Energy to inquire about this LCOE formula. We were answered by a senior analyst at NREL, who explained that there are two categories for methodologies for calculating LCOE: a recovery-based model and a cash-flow approach. The analyst clarified that “Most discounted cash flow models I’ve seen tend to not discount the energy denominator.” We believe the cash flow model is the most relevant here because it is used to calculate the NPV of an investment whereas a recovery-based model replaces cash analyses with a simplifying formula.

The National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources (known as the NSPM) includes a section on discount rates and a table (below) showing common discount rates by utility type. The NSPM recommends a low-risk discount factor for energy efficiency because it is a low-risk investment.[12] The NSPM table below shows a low-risk discount rate of -1% to 3%, much lower than the

[12] National Efficiency Screening Project, National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources, May 18, 2017.

8% used by TVA for all resources.[13] Higher discount rates put resources with higher upfront costs (i.e. energy efficiency and renewables) at a disadvantage to resources with ongoing lifetime costs (i.e. gas, coal, nuclear).

Figure 4. Table of Discount Rate Options for Cost-Effectiveness Analyses

Type of Discount Rate	Potential Indicator of Time Preference	Typical Values (in real terms)	Notes and Sources
Societal	Societal cost of capital, adjusted to consider intergenerational equity or other societal values	<0% to 3%	In addition to low-risk financing, government agencies have a responsibility to consider intergenerational equity, which suggests a lower discount rate (US OMB 2003). Society's values regarding environmental impacts might warrant the use of a negative discount rate (Dasgupta, Maler, and Barrett 2000).
Low-Risk	Interest rate on 10-year U.S. Treasury Bonds	-1.0% to 3%	Over the past decade the real interest rate on 10-year U.S. Treasury Bonds ranged between -0.6% and 3.0% percent. As of the publication of this document, the real interest rate on 10-year U.S. Treasury Bonds was 0.4 percent (multpl.com 2017).
Utility Customers on Average	Customers' opportunity cost of money	varies	Customers' opportunity costs can be represented by either the cost of borrowing or the opportunity costs of alternative investments (Pindyck and Rubinfeld 2001, 550). The real rate on long-term government debt may provide a fair approximation of a discount rates for private consumption (US OMB 2003).
Publicly Owned Utility	Publicly owned utility's cost of borrowing	3% to 5%	Publicly owned utility costs of capital are available from the Federal Energy Regulatory Commission Form 1, Securities Exchange Commission 10k reports, and utility Annual Reports.
Investor-Owned Utility	Investor-owned utility's weighted average cost of capital	5% to 8%	Investor-owned utility costs of capital are available from the Federal Energy Regulatory Commission Form 1, Securities Exchange Commission 10k reports, and utility Annual Reports.

Typical values of discount rates are in real terms, as opposed to nominal. Real discount rates should always be applied to real cash flows, and nominal discount rates should always be applied to nominal cash flows. The utility cost of capital should be after-tax.

Source: National Efficiency Screening Project, National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources, May 18, 2017.

TVA should not discount the energy savings when calculating the LCOE of energy efficiency options in its IRP modeling, but if it continues to use this inappropriate methodology, it should use a more appropriate discount rate of

[13] Ibid.

3% or less. Energy efficiency costs are just one way TVA is manipulating IRP assumptions to remove any obligation for energy efficiency from the utility. It is irresponsible and goes against TVA's mandate under the TVA Act to prioritize residents of the Tennessee Valley and perform system planning to optimize the lowest possible system cost.

2.1.5 TVA should model more energy efficiency program options

The NPCC, as indicated by the number of references in these and our IRP Scoping Comments to TVA, represent the model of the future for treating energy efficiency as a resource in resource planning. NPCC provided workbooks containing the supply curves used to calculate the cost-based measure bundles input into the resource planning model. These bundles were generated using cost and savings parameters of over 4,000 individual energy efficiency measures.[14] The range of efficiency programs modeled by TVA fails to adequately encompass the range of available options. Furthermore, the way TVA groups measures and programs together in its modeling lacks appropriate granularity. **TVA should expand the number of energy efficiency measure options available to the IRP model and use a supply curve based on buckets of installed capacity for each measure.** Only if TVA updates this modeling technique and uses correct calculations for energy efficiency potential and costs can TVA truly claim to "treat demand and supply resources on a consistent and integrated basis," as required by the TVA Act.[15]

2.2 Supply-side resource assumptions

2.2.1 TVA should not impose arbitrary constraints on supply-side energy resources

In the Draft 2019 IRP, TVA imposes arbitrary annual caps of 500 MW on utility-scale solar additions, which is a total limit of 8,000 MW because solar additions were only allowed in 16 years (2023-2038).[16] In 22 of the 30 IRP cases the resource planning models built up to the annual caps, suggesting that the model would select additional cost-effective solar if allowed.

Section 5.2.2 of the Draft IRP does not disclose caps on annual solar or wind deployment. TVA's first disclosure of this information, to our knowledge, was in response to a data request SACE made through NEPA and FOIA. In response to SACE questions, TVA staff stated that "It should be noted that there are limitations on the timing of other resource additions as well, such as how many new thermal builds can be planned for a given year, to reflect the practicality of when TVA has knowledge of

[14] NPCC Seventh Power Plan Conservation Files, Available at: https://nwcouncil.app.box.com/v/7thplanconservationdatafiles.

[15] U.S. Code Title 16, Chapter 12A, §831m-1(b)(2)(C)

[16] TVA also imposed a 10,000 MW overall limit to overall solar capacity additions, but the reason for that limit is unclear given the annual limits.

the need and other project management considerations."[17] None of these details are provided in the IRP and thus would be difficult to comment on.

We have learned that TVA has performed several relevant sensitivities since publication of the Draft IRP.

- In the accelerated solar sensitivity, TVA learned that the model brings "economic solar additions forward," and adds an additional 800 MW of solar. This sensitivity retained the annual cap of 500 MW, so the additional two years of solar development increased the model opportunity for solar by only 1,000 MW. Somewhat disingenuously, TVA noted that the total nameplate MW of solar remained below 10,000 MW – since the annual caps were set to limit total nameplate MW of solar to 9,000 MW, this was a result of TVA's constraints and not a result of model economics.
- The "double annual solar cap" sensitivity also found that the model would increase solar, in this case by 750 MW, and accelerate solar development to earlier years (although development in the 2020-2022 timeframe was not allowed).
- The "no annual solar cap" sensitivity adds 1,300 MW of additional solar.

These sensitivity results demonstrate that TVA's model constraints result in underestimating the economic benefits of solar in its Base Case Strategy. Furthermore, TVA only performed these sensitivities on the Current Outlook Scenario and Base Case Strategy, which is not one of the cases where the solar caps were hit in most or all of the years modeled. **TVA should perform these sensitivities for all 30 cases and present those results in the final IRP.** Without this information TVA will not be evaluating all IRP cases equally.

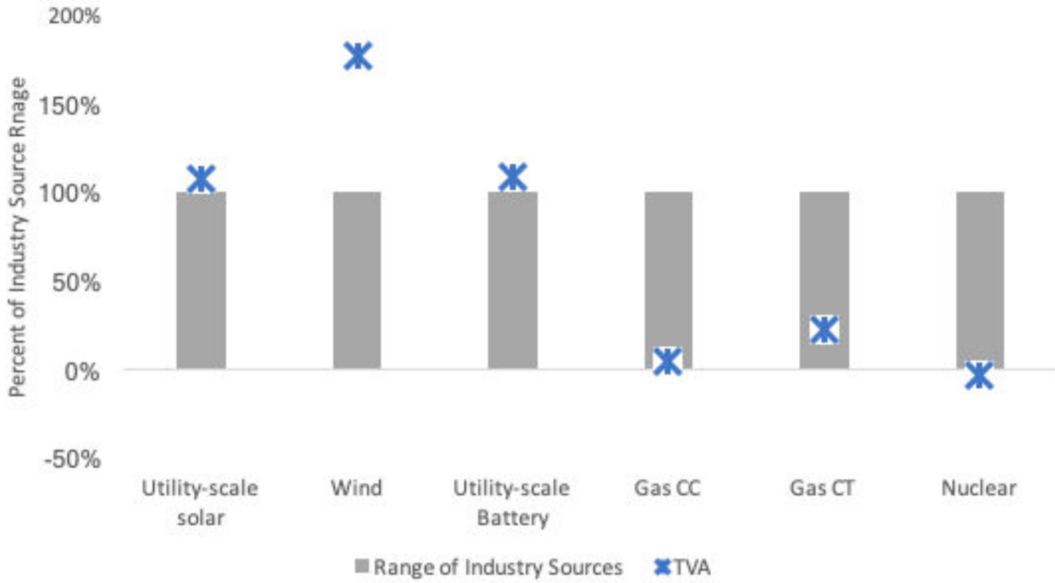
2.2.2 TVA should update supply-side resource costs to be objective

While TVA benchmarked supply-side resource costs using a third party (Navigant Consulting), TVA still picked high resource costs for resources that do not fit with TVA's 20th century utility model. Demand-side resources were not benchmarked.

As indicated Figure 5, TVA used high estimates for solar, wind, and storage but low estimates for gas and nuclear resources. SACE reviewed several of the latest industry sources for both current and projected costs of renewable energy and energy storage technologies. TVA assumptions were higher than any industry sources for solar, wind, and utility batteries. In the case of wind TVA's assumption is 177% of the highest industry source for comparable costs. TVA's inaccurate assumption eliminates a viable and affordable options: wind.

[17] TVA FOIA document SACE Responses_04022019.pdf, provided to SACE via email on April 3, 2019 and made publicly available by SACE at: https://cleanenergy.org/blog/last-minute-transparency-tva-releases-key-planning-data-days-before-comment-deadline/.

Figure 5. Comparison of Overnight Capital Costs

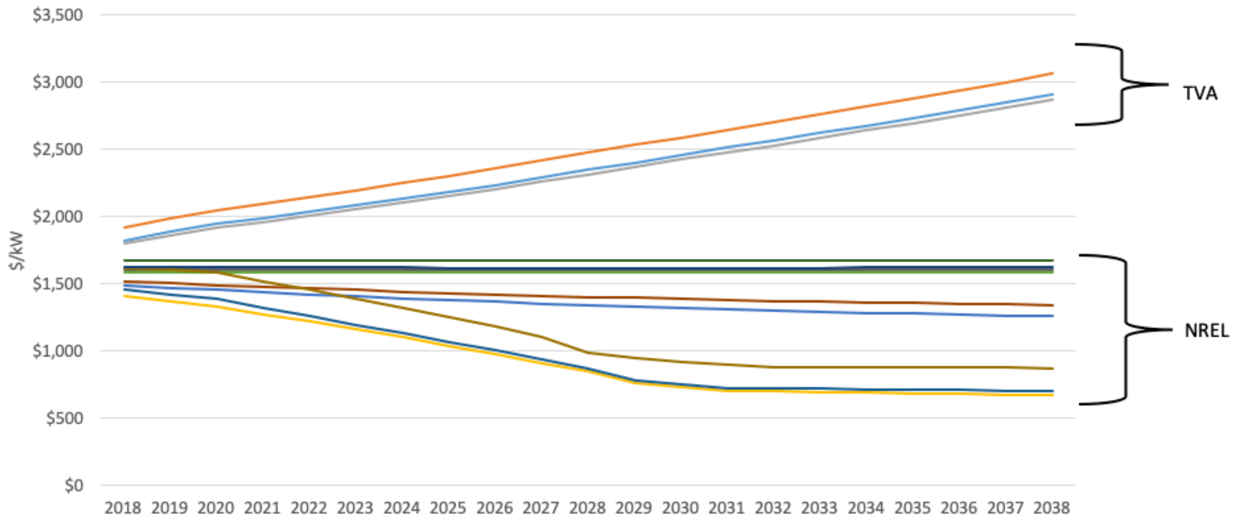


Notes and Sources:

- *Industry sources are NREL's 2018 Annual Technology Baseline (a compilation of 9 projections) for projects online in 2023 and Lazard's 2018 Levelized Cost of Energy that summarizes actual current costs.*
- *TVA's costs are derived from the draft IRP pages A-4 and A-5.*
- *TVA's nuclear costs are for SMR plants. Industry sources quote costs for conventionally-sized "advanced nuclear" plants because these industry sources consider the costs of SMRs too speculative to quote.*

In fact, the Draft 2019 IRP contains no cases that include wind. As seen in Figure 6, TVA assumes wind costs increase with inflation throughout the forecast. Therefore, despite beginning with costs that are somewhat aligned with industry sources like the NREL ATB, TVA's wind costs diverge from commonly used projections of wind forecasts. **TVA should realign the wind cost forecasts used in its IRP and rerun all IRP cases**. Having cost-effective wind in its portfolio will help TVA lower emissions, balance solar, and keep energy rates low.

Figure 6. Comparison of TVA Wind Cost Forecast to NREL ATB Wind Cost Projection

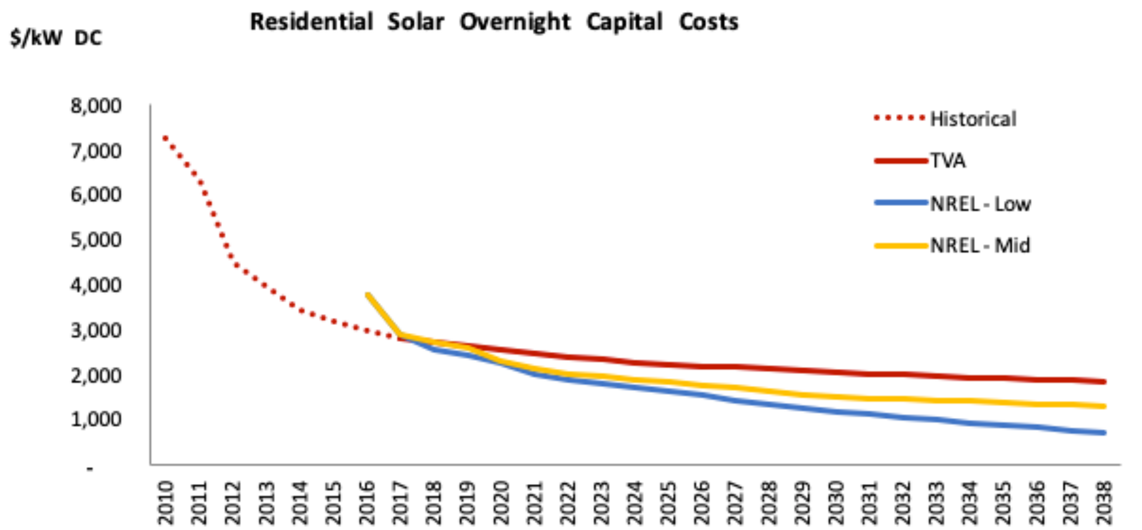


Sources: TVA FOIA document Solar Storage Wind Capital Costs_readonly.xls, provided to SACE via email on April 3, 2019 and made publicly available by SACE at: https://cleanenergy.org/blog/last-minute-transparency-tva-releases-key-planning-data-days-before-comment-deadline/ and NREL 2018 Annual Technology Baseline, available at: https://atb.nrel.gov/electricity/2018/.

SACE found TVA's forecast for utility-scale solar costs to represent reasonable trends in the later years of the forecast.

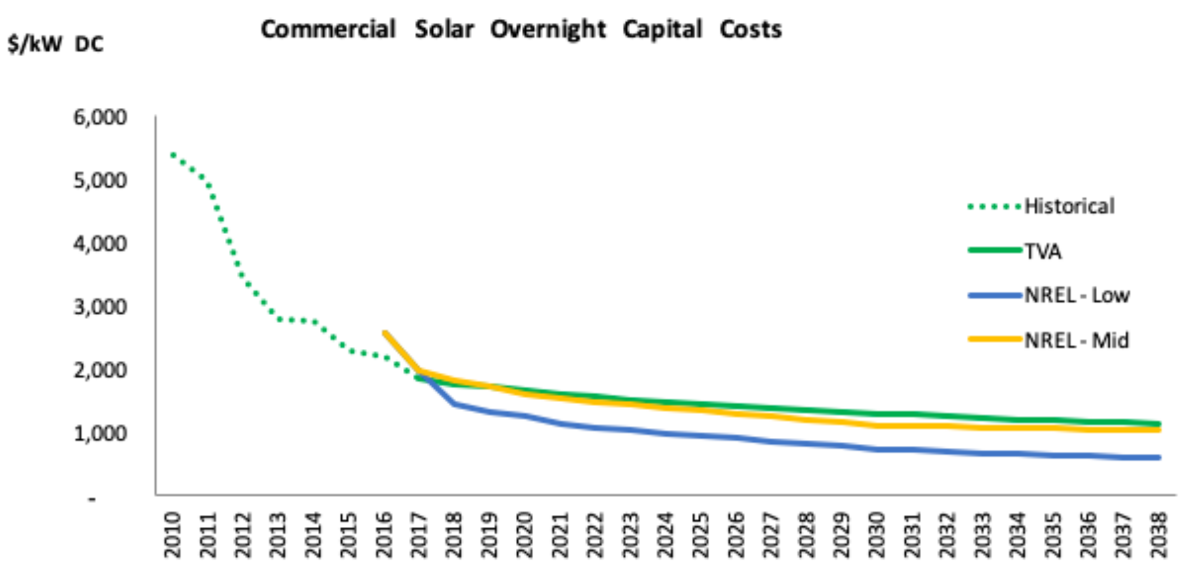
TVA's forecast of distributed solar project overnight costs does not match industry-standard projections. Despite the fact that solar costs have declined faster than industry forecasts, TVA's forecast for residential solar cost is 30-60% higher than NREL forecasts by 2038, as seen in Figure 7. TVA's forecast for commercial solar cost is also higher than NREL forecasts, as seen in Figure 8. **TVA should update distributed solar cost forecasts to better reflect long-term cost projections and rerun its distributed solar forecast model prior to finalizing the IRP.** Without these updates the IRP will not provide a useful roadmap based on likely DER trends.

Figure 7. Comparison of Residential Solar Cost Projections



Sources: TVA FOIA document Solar Storage Wind Capital Costs_readonly.xls, provided to SACE via email on April 3, 2019 and made publicly available by SACE at: https://cleanenergy.org/blog/last-minute-transparency-tva-releases-key-planning-data-days-before-comment-deadline/ and NREL 2018 Annual Technology Baseline, available at: https://atb.nrel.gov/electricity/2018/.

Figure 8. Comparison of Commercial Solar Cost Projections



Sources: TVA FOIA document Solar Storage Wind Capital Costs_readonly.xls, provided to SACE via email on April 3, 2019 and made publicly available by SACE at: https://cleanenergy.org/blog/last-minute-transparency-tva-releases-key-planning-data-days-before-comment-deadline/ and NREL 2018 Annual Technology Baseline, available at: https://atb.nrel.gov/electricity/2018/.

2.2.3 TVA should update its solar and wind data

According to Section A.4.4, TVA continues to rely on solar data provided by Clean Power Research in 2014 and wind generation data "based on simulation of TVA's existing wind contracts." Since the 2014 data were created there has been significant technological development in terms of solar panel output, inverter selection, and other relevant technology. Since TVA contracted for power, wind turbines have trended towards larger generation capacity, with taller towers and longer blades. TVA has updated its cost data for all technologies, and its performance data for gas technologies. However, neither the solar nor wind performance data reflect current technology.

If TVA has updated its analysis of Net Dependable Capacity (NDC) for solar and wind since the 2015 IRP, these analyses have not been provided for public review. The information provided in the Draft IRP and data received from TVA in response to a request under NEPA and FOIA was not sufficient to provide informed evaluation of the methodology used to calculate NDC for these resources.

2.2.4 TVA should include dispatchable solar and wind options

Another way in which the Draft 2019 IRP fails to update its assumptions about solar and wind power is that it fails to consider the potential to utilize these resources as dispatchable. A number of recent solar and wind projects have been deployed as dispatchable resources, and studies show that solar and wind can provide many of these flexible benefits.

In particular, "dispatchable" or "fully flexible" solar options that can provide necessary system flexibility or support capacity services. This is described in a report that reviewed Duke Energy's proposed solar integration charge.

> *"Modern solar plants can control their output faster and more accurately than conventional generators. If they are equipped with automatic generation control (AGC) they can provide that response to the system operator during contingencies. Solar plants normally operate at their full available output, and have no reserve capacity to offer, because they have zero marginal production cost and are therefore more economic than fuel burning generators. If, however, a solar generator is curtailed for some reason it will have available generation capacity that could be called upon to support power system reliability." (p. 10)*[18]

The financial and operational advantages of AGC on solar plants has been demonstrated in recent studies. An NREL report published March 2017 found that solar and wind equipped with sophisticated "grid friendly" controls can contribute to grid

[18] Brendan Kirby, *Duke Energy Proposed Solar Integration Charge*, filed by Southern Alliance for Clean Energy, North Carolina Utility Commission Docket NO. E-100, Sub 158 (March 3, 2019).

stability and reliability.[19] A study for Minnesota Pathways published in November 2018 found that additional solar capacity coupled with curtailment is less expensive than seasonal storage.[20]An E3 report published October 2018 looked at operating solar in four modes: "Must-Take," "Curtailable," "Downward Dispatch," and "Full Flexibility." The report uses the conditions of Tampa Electric's actual system to show that much of the inflexibility attributed to solar in traditional modeling is because it is modeled in the "Must-Take" mode only.[21] The E3 report found continuing value for solar power on the Tampa Electric system at the highest level tested (28% penetration) using the "full flexibility" mode.

For wind generation this phenomenon is sometimes called "over-subscription." **TVA should include the following new resources in its IRP modeling, with relevant updates to costs, NDC, and capacity factor: curtailable solar, downward dispatch solar, full flexibility solar, and oversubscription wind.** The inclusion of these resources along with reasonable cost assumptions and the elimination of arbitrary caps on resources will allow the model to do a true least-cost analysis.

2.2.5 TVA should allow model to retire existing nuclear to avoid relicensing costs

The IRP base case should assume substantial additional licensing and capital costs to both achieve and maintain an 80-year license via the NRC's Subsequent License Renewal (SLR) process as well as longer routine maintenance and inspection periods in order to test whether the units have substantial marginal value to the system.

TVA assumes in its base case and most scenarios that all existing nuclear plants will be relicensed at the end of their current license. TVA's Brown's Ferry will reach the end of its current 60-year license in the 2033-2036 timeframe, near the end of TVA's current draft plan. Currently, only two SLR applications have been submitted to the NRC so there is no precedent for TVA to rely on the operation of its nuclear fleet for 80 years.

Furthermore, we do not agree that TVA can assume all licenses will be renewed without significant costs. Most nuclear plants in the U.S. were built between 1970 and 1990 and given a 40-year license by the NRC. Many of those licenses have been extended beyond the original 40 years to include another 20 years, often at significant cost. However, it is unclear whether these plants can and should be operated an additional 20 years (i.e. 80 years), without substantial and perhaps cost-prohibitive capital investment.

---

[19] Loutan et al, *Demonstration of Essential Reliability Services by a 300-MW Solar Photovoltaic Power Plant*, NREL, March 2017. Available at: https://www.nrel.gov/docs/fy17osti/67799.pdf.

[20] Clean Power Research, Solar Potential Analysis Report, November 2018. Available at: http://mnsolarpathways.org/spa/.

[21] E3, *Investigating the Economic Value of Flexible Solar Power Plant Operation*, October 2018 Available at: https://www.ethree.com/wp-content/uploads/2018/10/Investigating-the-Economic-Value-of-Flexible-Solar-Power-Plant-Operation.pdf.

In TVA's reply to our request for additional documents, TVA expects, based on preliminary industry estimates, that nuclear relicensing costs for the three-unit Browns Ferry nuclear plant may range from $1 billion to 3 billion. TVA provided no reasonable basis for arbitrarily selecting $2 billion as the modeling assumption.[22]

TVA also stated that work related to Browns Ferry's subsequent relicensing would take place as much as feasible during standard refueling outage schedules for a number of years ahead of relicensing. TVA provided no basis for demonstrating that this assumption can be relied on, and provided no basis for assuming that post-SLR maintenance and operation costs would be similar to present conditions.

Given the scarcity of data provided by TVA, we strongly question what "preliminary industry estimates" relied upon by TVA might represent beyond guesses. **TVA should provide a detailed description of the costs associated with the SLR application and compliance process (licensing, engineering, equipment/plant modifications and upgrades, etc.) along with supporting documentation to support such estimates prior to finalizing the IRP.** Without such support, it appears that TVA has selected assumptions with the goal of presuming that operating Browns Ferry for 80 years is economic.

Section 3.2.3 of the Draft EIS lists generating facilities that were allowed to retire due to economics in the IRP modeling. No nuclear facilities are included in this section, thus we conclude that TVA did not allow the model to retire Brown's Ferry in order to avoid the additional costs associated with license renewal (i.e. the $2 billion assumption used in this case). **For the final IRP TVA should allow any existing generation to retire to avoid continued costs.** This is the only way to a true least-cost planning process that optimizes the entire system's costs.

2.2.6 Generation start years should reflect project lead-time

TVA should certainly not limit utility-scale solar to 2023. The EIA estimates that utility-scale solar can be online in 2 years in their 2019 Annual Energy Outlook.[23] TVA does not provide a reason in its draft IRP for their solar lead-time to be more than double that of standard industry assumptions. There is no reason that utility-scale solar should be constrained in 2021 and subsequently.

TVA could acquire and commission solar resources as early as 2020. SACE is aware that many area developers have projects in advanced stages of development in order to take advantage of higher federal tax credits, acquiring these resources immediately

---

[22] TVA FOIA document SACE Responses_04022019.pdf, provided to SACE via email on April 3, 2019 and made publicly available by SACE at: https://cleanenergy.org/blog/last-minute-transparency-tva-releases-key-planning-data-days-before-comment-deadline/

[23] U.S. EIA, "Cost and Performance Characteristics of New Generating Technologies, Annual Energy Outlook 2019." Available at https://www.eia.gov/outlooks/aeo/assumptions/pdf/table_8.2.pdf.

could generate savings for ratepayers. Furthermore, NREL's 2018 ATB reports that utility-scale solar development can be completed in 1 year.[24]

Updates should also be made to the In-Valley wind and Battery storage online years to 2022 and 2020, respectively. The EIA assumes wind projects have a 3 year lead-time and utility battery storage projects have a 1 year lead-time.[25]

Conversely, the start year for certain generation technologies should be pushed back beyond 2023. This may not affect the IRP significantly, because these resources are not chosen by the model unless they are forced in manually by TVA staff. Nuclear projects of any kind have longer lead-times and would not be available in 2023. The EIA assumes nuclear projects have a 6 year lead-time, which seems rather unsupportable given recent issues with nuclear project development.[26]

2.2.7 TVA should evaluate the impact of climate change on generation

TVA states in the Draft EIS that "TVA's Adaptation Plan (TVA 2016g) specifies that each TVA major planning process shall identify any significant climate change risks."[27] However, neither the Draft IRP nor the Draft EIS indicate that TVA modeled and impacts of climate change on its existing generation fleet. TVA relies heavily on generation from hydro and water-cooled nuclear and fossil power plants, two technologies likely to be impacted by climate change.

Increases in water temperature present the need to curtail water-cooled generation resources. SACE comments on this matter in the process for TVA's 2015 IRP. In its response, TVA acknowledged this issue, noting that it had already derated individual plants and installed additional cooling at others. Since this is an ongoing issue and not a one-time phenomenon, **TVA should include the costs of expanding water cooling capability in the operations and maintenance costs of existing water-cooled generation or deduct the derated capacity from the Net Summer Dependable Capacity from water-cooled generation.**

It is concerning that this was still not addressed in the Draft 2019 IRP despite TVA's response from our comments in 2015 acknowledging the issue. This is just one climate change related risk. **TVA should evaluate the potential impacts of climate change on its existing and future generation resources as a part of this planning process.**

---

[24] NREL (National Renewable Energy Laboratory). 2018. 2018 Annual Technology Baseline. Golden, CO: National Renewable Energy Laboratory. http://www.nrel.gov/analysis/data_tech_baseline.html.

[25] Ibid.

[26] Ibid.

[27] Draft EIS, page 4-20

3. Energy Efficiency

3.1 TVA is out of step with industry peers on energy efficiency

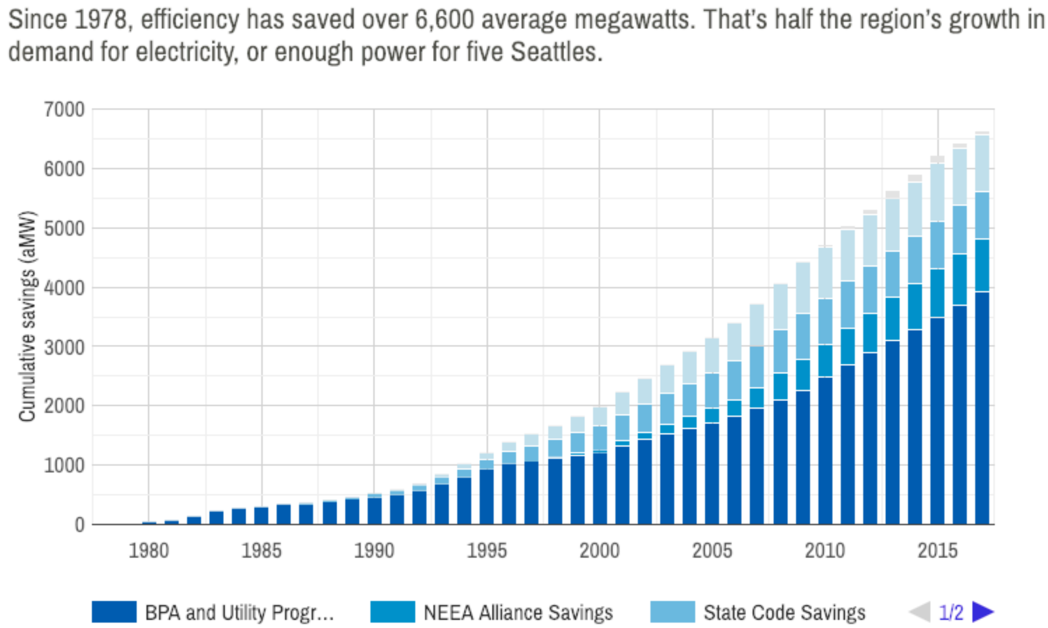
TVA is a large electric provider, but trails far behind regional leaders in energy efficiency and is failing to deliver the significant financial benefits from efficiency available to customers in neighboring jurisdictions. In 2017, TVA captured a mere 0.21% energy savings from efficiency as a percentage of previous year's total electric sales. By comparison Georgia Power had more than double the energy savings (0.46%), Duke Energy Carolinas had five times more (1.09%), and Entergy Arkansas delivered six times more efficiency savings than TVA.

The contrast between TVA and Entergy Arkansas is particularly telling. While the utility is a mere fraction of TVA's size, Entergy Arkansas delivered over $300 million of net customer benefits (TRC NPV) in 2016 and 2017 alone. While Entergy's efficiency programs have consistently exceeded its targets and come in under budget, TVA has slashed its efficiency investments every year since 2014 with corresponding declines in annual energy savings.[28]

TVA lack credibility in its claim that energy efficiency can provide little to no benefit to any of their resource planning portfolios because they have failed to provide reviewable information at appropriate levels of granularity, did not show work papers required to validate their claims, and they have provided no studies or other empirical evidence to back up most of their key assertions. Together, this makes even basic review and verification of its analysis impossible and undermines the potential for meaningful recommendations to overcome shortcoming in their modeling methodologies. As a general point of comparison, though, the Northwest Power and Conservation Council (NPCC) conducts regional integrated resource planning, is mandated to optimize efficiency against supply resource additions, and has shown that efficiency investments routinely beat out traditional generation resources, as seen in Figure 9. The failure of TVA's models to capture significant efficiency resources in their many portfolio outputs, despite numerous program costing less than $20/MWh, suggests a serious flaw in its modeling practices that require intense scrutiny before any final decisions are made regarding this integrated planning cycle.

[28] It is difficult to assess TVA's energy efficiency investments because TVA's energy efficiency cost data reported to the EIA appears to include "beneficial electrification." It appears that TVA has been ramping up investment in beneficial electrification while simultaneously cutting its energy efficiency budget.

Figure 9. History of Energy Efficiency Savings in the NPCC Territory



Source: Northwest Power and Conservation Council

The NPCC is TVA's counterpart in the Northwest and has seen steady energy efficiency savings since the 1980s despite a "rising baseline." As seen in the chart below, NPCC compares historical energy savings from utility investment to savings from those driven by outside sources: market momentum, federal standards savings, state code savings, and the Northwest Energy Efficiency Alliance (NEEA) Savings. Utility-derived savings increased at least linearly each year from 1980 through 2016.

Despite (or perhaps because of) having success with previous energy efficiency programs, the NPCC's calls for continued efficiency increases going forward in its Seventh Power Plan, which is its equivalent to TVA's IRP.

Figure 10.NPCC Seventh Plan Six-Year Energy Efficiency Goal and Milestones

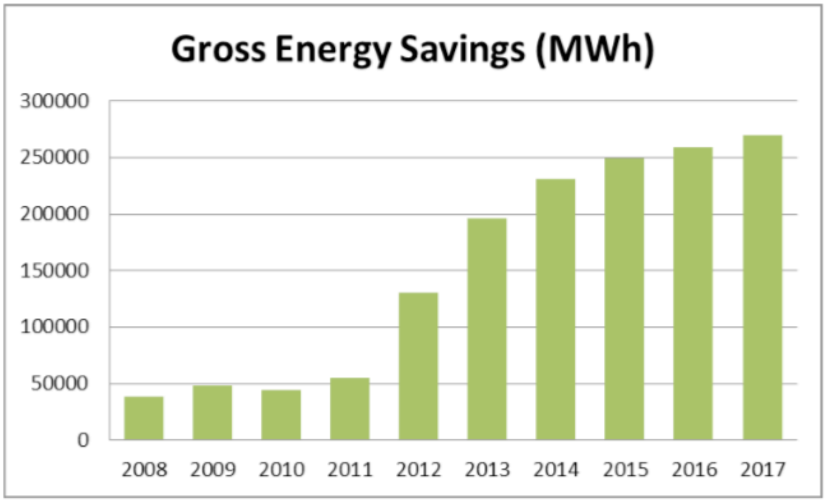
	2016-2017	2018-2019	2020-2021
Bi-Annual Energy (aMW)	370	460	570
Cumulative Energy (aMW)	370	830	1,400

Source: Northwest Power and Conservation Council, Seventh Power Plan Midterm Assessment, February 2019

Entergy Arkansas (EAI) also continues to see increasing annual savings driven by its energy efficiency programs despite increases in the baseline (i.e. federal efficiency standards, local and state codes) experienced by all utilities, and it continues to include investment in energy efficiency in its resource plans for the future.

Figure 11. Annual Savings from Energy Efficiency by Entergy Arkansas

Table 1.1.2 – Gross Energy Savings

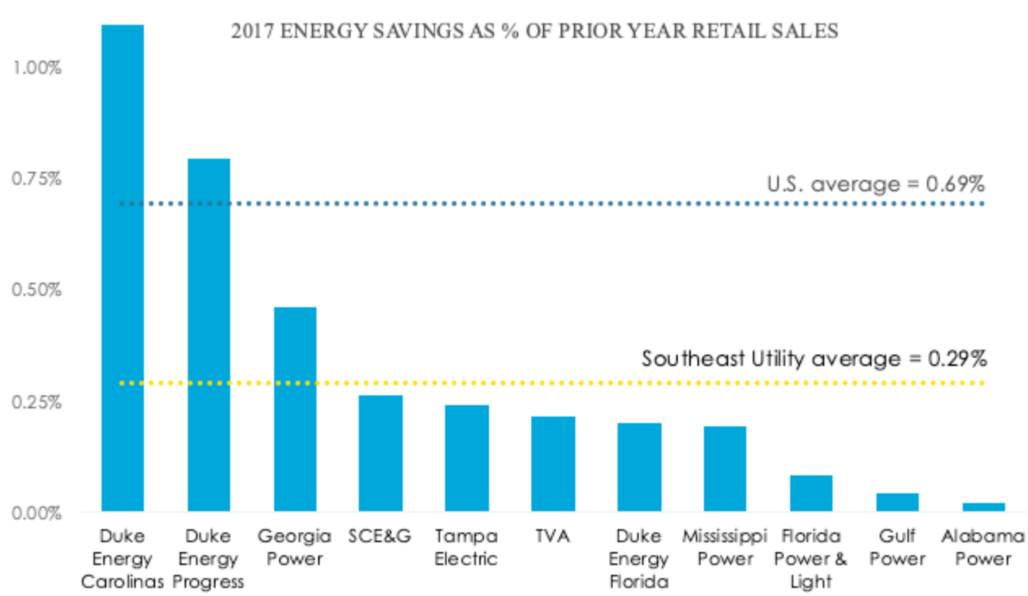


Source: Entergy Arkansas, 2018 Annual Energy Efficiency Report

3.2 TVA will fall further behind Southeast utilities in EE under any of these plans

In the 2011 IRP, the TVA Board set goals to achieve 1% annual savings from energy efficiency. Its goal was dropped to 0.6% in the 2015 IRP. The draft 2019 IRP further drops the energy efficiency goal to zero by the end of the study period. TVA's annual energy savings fell below the regional average and well below the national average in 2017. TVA should return to the goal of being a regional leader in energy efficiency.

Figure 12. 2017 Energy Savings for Major Southeast Utilities



Source: SACE [Energy Efficiency in the Southeast 2018 Annual Report]

TVA now treats energy efficiency as a threat to its revenues, and is adding large mandatory fixed fees to customer bills. The Draft 2019 TVA IRP fails to quantify the impact of shifting costs from energy rates to mandatory fixed fees on customer energy use. It is well known that this rate design approach will lead to higher, less energy efficient behaviors. Furthermore, as these billing changes take effect, the economic incentive to invest in energy efficiency will be reduced. For example, Knoxville Utility Board's decision to triple fixed fees has the effective of wiping out 10 years' worth of efficiency savings effect.

TVA was once a leader on certain energy efficiency programs. TVA pioneered a low-cost, high-impact program for manufactured homes that now serves as a model for other utilities. This important customer sector continues to be overlooked by many other utilities, and TVA is to be commended for developing this program. The program also that energy efficiency savings are within TVA's reach if the utility is willing to make the investment and that such programs save customers money and improve livelihoods across the Valley.

3.3 Scorecard should not include Total Resource Cost metric

TVA is misguiding readers by including the Total Resource Cost metric in TVA's 2019 IRP metrics. TVA has not previously utilized this metric and the Draft 2019 IRP does not explain why it is needed. Only the cost to the utility to acquire energy is relevant.

The total resource cost metric needs to be distinguished from the total resource cost test used in energy efficiency program design and review. In that context, it is a more appropriate test because it informs the program administrator about how different programs compare without respect to the incentive level or other program costs that may be incurred. From a utility point of view, the program administrator or utility cost test is often used to determine the degree to which a program is appropriate for investment by the utility. This is similar to TVA's PVRR and system average cost metrics, which we support as appropriate metrics consistent with TVA's mission.

Using a total resource cost analysis for IRP purposes is a frankly patronizing approach: customers may have very good reasons to invest in technologies such as building insulation, energy efficiency appliances, self-generation, or storage. These customer-driven investments help TVA reduce costs, and TVA should incentivize them appropriately. TVA's metric values the benefits of such investments solely on the basis of system cost savings, but the costs as incurred by both the system and by customers.

This unbalanced consideration of costs and benefits could be remedied by including customers' non-energy benefits – such as health, comfort, resilience, or values-based investing. We are not recommending this now because TVA would have to undertake an effort to comprehensively value such varied personal benefits. By presuming to call this a "total resource cost" metric, TVA has adopted an authoritarian attitude that these benefits are not part of the "total." It is not up to TVA whether customers should invest in such technologies beyond TVA's definition of economic rationality.

As such, near term rate impacts from energy efficiency programs will be significantly mitigated by broader customer participation in programs and the cumulative savings realized over the full lifetime of the implemented measures. For example, customers do not replace their HVAC every year, since the equipment has a long lifespan. Tim Woolf's analysis of Georgia Power's program participation finds that roughly a quarter of residential customers and a third of commercial customers were likely to participate over a three year time period (2017-2019).[29] His analysis demonstrates that over the long term, a large portion of customers will experience direct bill savings from energy efficiency programs and all customers will see bill savings passed on as a result of deferred investment in generation, transmission, and distribution.

Customers who participate in energy efficiency programs will typically experience reduced bills as a result of investments in energy efficiency that substantially exceed the costs borne at the utility system level. Accordingly, **TVA should restore its focus on a lowest system cost metric**. The TVA Act is clear that TVA's resource planning process must aim for the lowest system cost. The act specifies that "the term "system cost" means all direct and quantifiable net costs for an energy resource over its available life, including the cost of production, transportation, utilization, waste management, environmental compliance, and, in the case of imported energy resources, maintaining access to foreign sources of supply."[30] The Act further states that least-cost planning program will "treat demand and supply resources on a consistent and integrated basis."[31] The same section of the Act finally states that TVA is required to "Encourage and assist [LPCs] in the planning and implementation of cost-effective energy efficiency options."[32]

4. Regulatory Oversight

4.1 Strategies lack enough variation for meaningful comparison

The results from TVA's Draft 2019 IRP are nearly uniform for each scenario, suggesting the assumptions made in each strategy are not different enough to have a material impact on results, as seen in Figure 13. The Draft 2019 IRP fails to explore strategies that represent meaningful differences for stakeholders or the Board to use when recommending a strategy to inform TVA's future planning purposes.

---

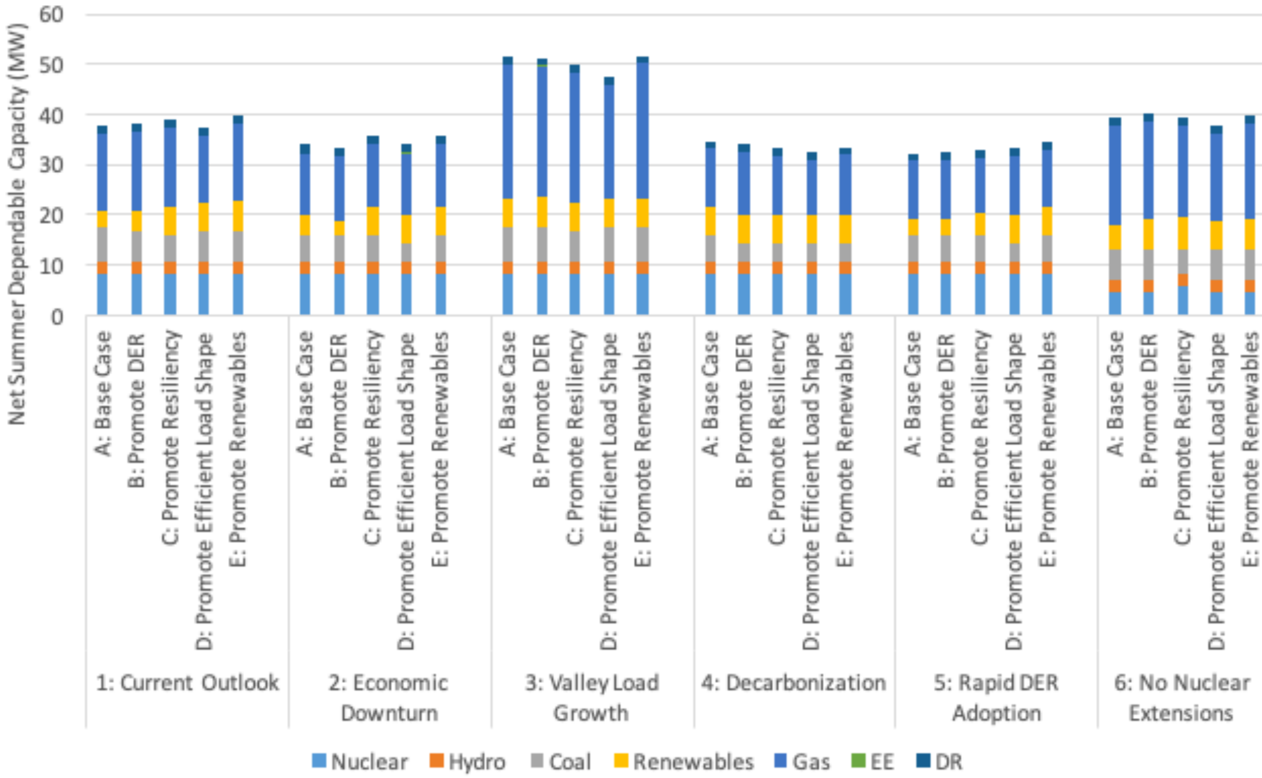
[29] Direct Testimony of Tim Woolf on the topic of Demand-Side Management on behalf of The Sierra Club, May 2, 2016, Georgia Power Company's 2016 Integrated Resource Plan and Application for Decertification of Plant Mitchell Units 3, 4A and 4B, Plant Kraft Unit 1 CT, and Intercession City CT. Georgia Public Service Commission Docket No. 40161 and Docket No. 40162.

[30] U.S. Code Title 16, Chapter 12A, §831m-1(b)(3)

[31] U.S. Code Title 16, Chapter 12A, §831m-1(b)(2)(C)

[32] U.S. Code Title 16, Chapter 12A, §831m-1(c)(2)

Figure 13. Capacity by Scenario and Strategy from TVA Draft 2019 IRP



Source: SACE, with data from TVA Draft 2019 IRP

As just one example, TVA's high incentives for distributed solar leads to that resource being 10% of total capacity in 2038 under the Current Outlook scenario. In its 2019 Annual Energy Outlook, EIA forecast that distributed solar will make up 6% of total capacity nationwide under current policy and economic conditions. TVA's highest level of incentives for this technology results in only marginally better penetration than EIA's modest projection under current conditions.

Across scenarios, it is notable that the lowest PVRR cases are for Scenarios 2 (Economic Downturn) and 5 (Rapid DER Adoption) for all strategies. The scenarios with the least overall CO2 emissions are Decarbonization and Rapid DER Adoption scenarios. For neither metric does the strategy matter much. However, the Rapid DER Adoption scenario has even lower emissions than the Decarbonization scenario and falls in the lowest cases for PVRR. Considering that TVA has a mission to support environmental stewardship and economic development, pursuing policies consistent with these two scenarios would be consistent with its mission.

It is evident that DER adoption can benefit the Valley through reduced costs, reduced emissions, and more customer options. **TVA should implement a strategy of DER integration that also includes the energy efficiency resources left out by its egregious modeling methodologies in this IRP.**

4.2 Call on TVA Board to reject IRP without meaningful changes from the draft

IRP processes should be transparent and involve stakeholders throughout the process. A successful IRP minimizes total system costs without limiting customer choice, leading to the lowest possible customer bills, not a myopic focus on rates or a patronizing focus on spending choices by private customers. A successful IRP evaluates the entire life-cycle cost of all resources, both supply and demand and both existing and potential. A successful IRP should be overseen by an engaged oversight body.

TVA states that its mission is "to improve the quality of life in the Valley through the integrated management of the region's resources." This IRP reflects a different mission – a mission to hold on to a 20th century business model without regard to the quality of life in the Valley, through centralized TVA management of the region's electricity resources. As a result, TVA appears poised to further downsize its investment in helping customers manage their energy bills and burdens, slow-walk or halt renewable additions, and continue to invest in old, expensive, inflexible resources. **We call on TVA to rebuild this IRP in a transparent and objective manner, and if its staff will not, we call on the TVA Board of Directors to reject the IRP in its current form.**