Friends of the Earth

June 6, 2020

MLGW PSAT
Memphis Light Gas and Water Division
220 South Main Street
Memphis, TN 38103

re: Friends of the Earth Comments to MLGW PSAT on Siemens Draft IRP Report and MLGW Decision to Leave TVA for a Cheaper, Cleaner, Greener and Renewable Wholesale Power Supply

Dear PSAT and MLGW Board, Officers and Staff:

In April 2019, MLGW decided to appoint a Power Supply Advisory Team (**PSAT**) to facilitate its efforts to conduct an integrated resource plan (**IRP**) tasked assessing and determining what its power supply needs, options, alternatives and opportunities would be for the future. In July 2019, MLGW selected Siemens Industry Incorporated, (**Siemens**) to facilitate this scope of work and has since released its preliminary findings for public comment.

In response to that request, I am formally submitting my feedback as a concerned citizen living in Memphis, Tennessee and a residential customer of Memphis Light Gas and Water. I also have the privilege and experience of having worked for Memphis Light, Gas and Water (MLGW) for almost 15 years including seven as President and CEO and also in the capacity of vice president and general counsel for eight years. During that time, I became very familiar with MLGW, its mission, and the significance of MLGW as TVA's largest customer. I continue to support energy focused initiatives as a consultant with Friends of the Earth, a volunteer nonprofit environmental group working to objectively and transparently support this issue as well.

Based on our review of the IRP, consultation with industry experts and analysist, subsequent findings, and on behalf of Friends of the Earth, I offer the following comments:

PSAT has been tasked with leading an "objective, industry-based study and evaluation" that considers "various factors necessary to reach an optimal solution from the perspective of our customers and our community in [a] recommendation regarding whether or not to continue to take wholesale power from TVA or pursue other options." In addition to their direct commissioned evaluation by Siemens, this decision should also consider expert third-party external reviews that have thoroughly vetted and researched this issue.

- Friends of the Earth has proven its commitment as an honest, objective, and unbiased resource in this ongoing discussion. It has at its own expense invested in national and internationally recognized utility and energy industry experts, consultants and analysist to review the issues raised by the MLGW IRP, the relationships with TVA, and the potential for savings should, MLGW decide to cease being a customer of TVA and purchase and secure its' power needs from another source.

In January 2019, Friends of the Earth released the Brattle Report entitled *Power to Memphis- Options for a Reliable, Affordable and Greened Future*, https://foe.org/projects/memphis-for-all/?issue=5, followed up by a second supplemental report from the Brattle Group, *Power to Memphis: Renewable and Storage Supplement* in September 2019. These reports from the recognized industry experts provided the analysis, documentation, and support for the Friends of the Earth recommendations that that MLGW leave TVA and secure an alternate power source.

- The Brattle Group, one of the industry expert resources in the world, provides consulting services and expert testimony in economics, finance, and regulation to corporations, law firms, and public agencies. These studies and supporting documentations have been made available to MLGW, the Mayor, the PSAT, the City Council and the public and should be factored into consideration.
- The Brattle Group indicated that the growing trend of lower market prices for solar and wind power could enable Memphis to achieve generating costs even lower than were identified in the prior report. As reported, Memphians could save up to $333 million dollars per year if MLGW were to terminate its contract with the TVA and directly buy or generate its own power.

The initial reported analysis by The Brattle Group in 2019 were reaffirmed by Siemens, the consultant hired by MLGW to oversee its integrated resource planning process, in their preliminary findings, *Integrated Resource Planning and Transmission Discussion PSAT Meeting*. Siemens' projections tracked and agreed with previous the Brattle Reports. A recently commissioned third report by The Brattle Group specifically examined the Siemens Draft IRP report.

- Siemens preliminarily findings found the potential of savings of up to 40% on wholesale power costs comparisons for Memphis by switching providers of its' wholesale power supply. Moreover, even when they factored in the potential costs of transmission and connection to alternative suppliers, which they viewed very conservatively, the savings remained significant at a 24% - 33% level, but were short of the savings suggested by the original two Brattle Reports.
- Review of the Siemens Draft IRP, however, suggests that differences in calculated potential cost savings are NOT primarily driven by differences in assumptions about the costs of the alternative sources of power supply that MLGW could rely on in the absence of a TVA power supply contract.
- Rather, there were discovered, several questionable assumptions, made by Siemens, which were contributing factors. In particular factors related to costs of transitioning and transmission costs away from TVA away from TVA system, and more precisely estimating any impact on PILOT, and other costs. If brought into line, these would likely substantially narrow (and perhaps more than close) the gap in the respective reports estimated potential annual cost savings.

Friends of the Earth also commissioned globally recognized expert, Synapse Energy Economics, Inc., to first examine the financial challenges TVA would encounter that would exert an upward pressure on their costs and thereby on their rates. And to in a second report analyze the Memphis's Power Supply Advisory Team's final Integrated Resource Plan report, which was prepared by the Siemens Group. The Integrated Resource Plan detailed the massive savings for Memphis if it leaves TVA. They concluded in each case the same:

- Remaining with TVA is by far more costly than the other options considered and has the least amount of renewable energy and thus riskier in terms of fuel price increases.

- The TVA options have the most carbon dioxide (CO_2) emissions and thus would place Memphis more at risk in the event of more stringent greenhouse gas regulations and associated costs. Furthermore, the TVA options are not compatible with the City of Memphis climate policy.
- Although the MLGW IRP looked at some issues that were raised in this report, there are further risks associated with TVA options that could further increase the cost of those options: Coal Ash Remediation Costs; Fossil Fuel Price Increases; Carbon Prices; Early Plant Retirements; and, Load Departures.
- The experts at Synapse Energy Economics. Inc., Energy Economics, Inc., concluded that departing from the TVA contract represents the most prudent and cost-effective choice for Memphis.

In addition to the highlights captured above, at least four other experts in the industry have concurred with the Friends of the Earth/ Brattle Group/ Synapse Energy Economics that leaving TVA and Procuring cheaper wholesale electricity for Memphis and Shelby County, would save hundreds of millions of dollars annually. And, although, TVA has been critical of the Siemens report in unanalyzed and unsupported conclusory statements in the media, nothing has been publicly presented to support their positions. While, comparatively, every public, expert study supported by analysis and documentation in the body of evidence, agrees that Memphis could save significant sums of money by leaving TVA.

For your convenient reference, I have linked or attached the several studies that Friends of the Earth has commissioned as well as summarized highlights in the pages to follow. I should point out for special emphasis that the June 26, 2020, Synapse Energy Economics report, and the June 24, 2020, Brattle Group Report, which were specifically commissioned for their review and comments, regarding and in response to the Siemens Draft IRP released in May 29, 2020.

We firmly believe that the analysis and findings from these multiple proven, credible and trusted sources make the MLGW decision to leave TVA one that is supportable, supported and obvious for the leaders considering this shift to a more reliable, renewable and economical resource for our power supply. I trust that PSAT, City and MLGW leaders will base their decision based on facts, but even more so, in the best interest of the City of Memphis and the ratepayers, consumers and customers that need it most.

Sincerely,

/s/ Herman Morris, Jr.

Herman Morris, Jr., Esq.
THE MORRIS LAW FIRM
119 S. Main Street, Suite 500
Memphis, TN 38103
Office: 901-468-3454
Direct Dial: 901-322-4395
Facsimile: 901-312-5501
Email: herman.morris@morrisfirmlaw.com

Consultant for Friends of the Earth

Friends of the Earth

THE Brattle GROUP

MEMORANDUM

TO: Friends of the Earth

FROM: Jurgen Weiss/The Brattle Group

SUBJ: Comments on MLGW Draft IRP by Siemens

DATE: June 24, 2020

We were asked by Friends of the Earth (FOE) to review the recently presented MLGW draft IRP prepared by Siemens.[1] Beyond a general review, we were asked in particular to examine why cost savings estimates in the draft IRP from leaving the TVA differ from the differences between the estimated TVA resource cost and various alternative resource portfolios developed by The Brattle Group in our report prepared for FOE in 2019.[2]

This memo summarizes our review and comparison of Siemens' draft IRP with our previous reports and the assumptions contained therein. The comparison is intended to provide high level observations and focuses on both commonalities and differences that materially affect the potential savings to MLGW and the citizens of Memphis from seeking an alternative power supply arrangement to a continued relationship with the TVA.

The memo is structured in three parts. First, it provides a high level summary of our observations. Second, it describes overlaps and differences in assumptions and results in areas where both the draft IRP and The Brattle Group reports can be compared. Third, it describes our observations in areas where the draft IRP and the Brattle Group reports cannot easily be compared, due primarily to differences in scope and focus of analysis.

1. High-level Summary of Observations

At a high level, the Siemens and Brattle reports come to a similar conclusion. Alternative power supply options to the current (and future) TVA contract could significantly increase the share of renewable energy (and correspondingly lower the amount of greenhouse gas emissions) providing power to Memphis, at costs that could save Memphis ratepayers billions of dollars over the coming decades. Importantly, any differences between estimated potential cost savings are **not** primarily the result of different assumptions about the cost of power supply from alternative sources such as wind and solar facilities, complemented by MLGW owned gas-fired generation or market purchases. Rather, they result from different assumptions about the cost of a continued contract

---

1 Siemens, DRAFT: Integrated Resource Plan Report, Memphis Light, Gas, and Water, May 2020

2 The Brattle Group, Power to Memphis; Options for a Reliable, Affordable and Greener Future, January 2019 and Power to Memphis: Renewable and Storage Supplement, September 2019

with the TVA as well as by costs estimated by Siemens to be incurred by MLGW in case of a non-TVA option going forward, but outside the scope of the previous Brattle reports.

Specifically, the supply costs of Brattle's portfolios range from $50/MWh to $59/MWh, compared to supply costs of $50/MWh for Siemens portfolios 5 and 9.[3] However, while Brattle's analysis assumed no incremental transmission (intended to show the cost of an "island" system relying only on existing transmission capacity), Siemens' analysis explicitly allows for the construction of new transmission both to access more resources outside of Memphis and for reliability reasons. These transmission costs have a Net Present Value Revenue Requirement (NPVRR) of $561 million for portfolio 5, or 6.2% of the portfolio's power supply NPVRR.[4] For portfolio 9, the transmission cost NPVRR is $469 million, or 5.2% of the portfolio 9 power supply NPVRR. Simply grossing up the power supply cost by the assumed transmission investments[5] would result in approximate power supply costs (including transmission) of $52-$53/MWh for portfolios 5 and 9, well within the range of Brattle's portfolio and even about 10% lower than the $59/MWh estimated cost for the "Higher RE" portfolio likely most comparable to portfolios 5 and 9 (based on a more comparable share of renewables). Hence, before taking into consideration costs that Brattle's work did not include in its scope of analysis, Siemens' draft IRP suggests power supply costs without a TVA contract may even be lower than those estimated by Brattle. Given that The Brattle Group conducted a much less detailed analysis, did not have access to MLGW transmission information and that assumptions about power generation technologies are derived mostly from the same sources (such as NREL), Siemens' generation cost estimates appear reliable.

It is also important to note some important methodological differences between the reports by Siemens and the Brattle Group that make a direct comparison of estimated potential savings more complicated. Chief among them is the fact that the draft IRP calculates levelized annual savings over a 15 year period from 2025 to 2039 whereas the Brattle Group reports estimated the cost of various "snapshot" portfolios in 2024 and in 2050. Also, the criteria of the portfolios constructed differed significantly, both with respect to the amount of renewables included in potential portfolios and the use of additional transmission to connect to MISO. Finally, the Siemens draft IRP includes significantly expanded reliability analyses not part of The Brattle Group's scope. Nonetheless, the estimated annual savings potential for the portfolio developed by The Brattle Group most closely matching the preferred portfolios by Siemens (Portfolios 5 and 9) – the 2024 "Higher RE" portfolio, are broadly consistent once some of the cost factors not in the scope of The Brattle Group's initial scope are taken into account. The Brattle Group estimated an annual cost difference between the higher RE portfolio and an estimated annual cost of a continued TVA

---

3 Siemens draft IRP, page 291 and 330.

4 Ibid, Exhibit 269, page 296

5 Using the transmission NPVRR as a percentage of the generation NPVRR to gross up the total rate is a simplification since the useful lives of the assets involved may differ, but should approximately capture the impact of including transmission in average generation costs including transmission.

contract at $201.5 million.[6] The Siemens draft IRP estimated potential levelized annual savings for Portfolios 5 and 9 of approximately $153 million per year.[7]

As explained in the next sections, this difference can in part be explained by some additional costs MLGW would likely indeed incur, but which were not part of the Brattle Group's initial scope, and in part by a small number of questionable assumptions made by Siemens in areas, resulting in material cost estimates.

2. Comparison in areas of overlapping assumptions

As already highlighted, both Siemens and Brattle make assumptions about the cost of alternative power supply portfolios, based on more fundamental assumptions about the evolution of costs over time of various types of resources such as onshore wind, large scale and smaller scale solar PV, batteries, etc.

The major differences between Brattle's analyses and those presented in the Siemens draft IRP relate to the cost of transmission (also already discussed above) and the assumed cost to MLGW of a continued contract with the TVA beyond 2024.

Because both the assumptions about the cost of future supply portfolios not involving TVA and transmission assumptions were already discussed above, this section focuses on the differing assumptions about the cost of continued TVA membership. The Brattle Group, in its analyses, had been instructed by FOE to assume an average cost of a TVA contract to MLGW of 7.5 cents/kWh (in $2017). By contrast, Siemens estimates future costs to MLGW under two separate cases: a continued contract with a five-year notice period, and a second option with a 20-year commitment resulting in an assumed discount. Since, at the time of preparing our reports, we did not have any knowledge of either the existence or the terms of an optional 20-year contract, the relevant comparison is between 7.5 cents/kWh assumed in Brattle's analyses and a continued contract with the TVA with a five year notice period.

While a direct comparison of the assumed costs by Brattle and Siemens is complicated by some of the same issues discussed above (annual versus net present value calculations, the use of different base years, method for allocating peak-related costs), we observe that, as Siemens acknowledges, Siemens' bottom-up calculation of an estimated TVA rate is not only below the 7.5 cents/kWh assumed by The Brattle Group, it is also materially below the **current** cost of power to MLGW.

Siemens uses a number of different approaches to estimate a future MLGW all-in rate ($/MWh), depending on whether TVA or Siemens assumptions are used for some of the projected TVA costs and whether the historic relationship between TVA's overall average rate and the MLGW rate or

---

[6] The Brattle Group, Power to Memphis; Options for a Reliable, Affordable and Greener Future, January 2019, page 16.

[7] Siemens draft IRP, Exhibit 9, page 16.

an allocation of TVA fixed costs based on the 200 highest peak hours is used to derive a projected MLGW rate going forward. Since it expresses its rates in $2018, to compare to the rate actually paid by MLGW, Siemens applies an inflation adjustment of approximately 2%[8] and compares inflation adjusted rate estimates to the "current" (2019) MLGW rate, which it suggests was $74.45/MWh. It appears that Siemens is assuming that the 2019 rate of $74.45 MWh will remain unchanged in 2020 since it inflation adjusts its estimated $2018 rates by two years and compares these to the actual 2019 rate without an inflation adjustment between 2019 and 2020. We are not convinced that this rationale is solid. Siemens argues it is consistent with the TVA's commitment not to increase rates for 10 years under the LTP agreement.[9] However, since no decision has been made on whether or not the LTP is the preferred option should MLGW decide to continue its contract with the TVA, it is also not clear that no inflation adjustment will occur.[10] We have therefore calculated the effect of Siemens' MLGW TVA rate projections on associated savings from leaving the TVA that would result from using MLGW's actual 2019 TVA rate rather than the rates calculated by Siemens (and comparing the computed Siemens rate to the rate actually paid in 2019 adjusted by one year of inflation to create a comparison based on $2020. The result of this comparison is shown below.

	Inflation	Rate 2018	Rate 2019	Rate 2020	Difference to MLGW Actual	Annual Memphis Demand	**Implied Additional Cost Savings**
	%	$/MWh	$/MWh	$/MWh	$/MWh	GWh	**$000 p.a.**
Siemens Projection (allocated to 200 top)	2.02%	$ 69.12	$ 70.51	$ 71.94	$ 4.02	13,786	**$ 55,355**
Siemens Projection (historic relationship)	2.02%	$ 69.21	$ 70.61	$ 72.03	$ 3.92	13,786	**$ 54,063**
TVA Projection (allocated to 200 top)	2.02%	$ 70.71	$ 72.14	$ 73.59	$ 2.36	13,786	**$ 32,542**
TVA Projection (historic relationship)	2.02%	$ 70.93	$ 72.36	$ 73.82	$ 2.13	13,786	**$ 29,385**
MLGW 2019 Actual	2.02%		$ 74.45	$ 75.95	$ -	13,786	

[8] It is actually somewhat unclear what inflation rate is used. Siemens uses a 1.37% real discount rate assuming a 3.5% cost of capital and a 2.1% inflation rate (Draft IRP, page 190). Since the three numbers are not mutually compatible – for example, 3.5% minus 1.37% would imply an inflation rate of 2.13%, we assume some of this is due to rounding. However, the calculations in the draft IRP converting $2018 to $2020 imply the use of an inflation rate of 2.02% rather than either 2.1% or 2.13%. Based on the available information, we have not been able to reconcile, but instead use an inflation rate of 2.02% consistent with Siemens' conversions of $2018 to $2020.

[9] Siemens Draft IRP, page 194.

[10] We do not have sufficient information about the LTP to evaluate whether a pledge not to increase rates implies no inflation related adjustment of rates.

As the table shows, adjusting the Siemens forecast for the TVA rate for the difference between the estimated 2020 rate and the actual 2019 rate paid, inflated to 2020, results in additional costs under a continued TVA contract of between roughly $30 million and $55 million per year. This represents a range of potential additional savings of a power supply alternative relative to continuing the current TVA contract. While these additional savings are not certain, a forecast of a future TVA rate that estimates a rate for 2019 or 2020 that is significantly below the actual rate paid likely underestimates the savings relative to staying with the current TVA contract since it is likely that at least in the next decade the actual costs of staying with the TVA would be higher than estimated in the Siemens draft IRP.

3. Comments on assumptions not analyzed by Brattle

Finally, we provide some comments about assumptions made in the Siemens IRP resulting in costs not previously analyzed by The Brattle Group. While we have no basis for analyzing Siemens' assumptions about the costs related to MLGW's organizational capacity should MLGW decide to seek an alternative power supply to the TVA,[11] it is indeed likely that some such additional costs would be incurred. However, these costs would be both likely modest and result in additional employment in Memphis and hence also provide some positive economic impacts on the city. Beyond these costs related to MLGW's organizational capacity, there are two costs Siemens includes in its analyses that are material enough to merit comment.

First, Siemens assumes that the $37 million per year of bill credit associated with the TVA's use of MLGW-owned transmission would go away if the TVA were no longer the power supplier to MLGW. If it is indeed the case that the payment is uniquely for flowing power supply to MLGW over MLGW owned transmission, this assumption may well be correct. However, it is also possible that some of the use of MLGW infrastructure by the TVA might continue even if the TVA no longer supplied power to MLGW. This could be the case if TVA continues to own and operate the Allen plant and if transporting power from the Allen plant to remaining TVA customers would require continued use of MLGW transmission infrastructure. We therefore suggest that Siemens provide more information about the nature of the payments, at a minimum to create more transparency about the nature of this bill credit and its potential loss.

The future of the Allen plant is also relevant for the final material cost assumption in the Siemens draft IRP: payments in lieu of taxes (PILOT). Siemens assumes that the TVA's current PILOT would go away if MLGW canceled its current power supply agreement with the TVA. These PILOT represent approximately $50 million per year.[12] While we have not conducted analyses

---

[11] Siemens identifies $4.6 million in capital expenditures as well as operational expenses of between $1.3 million and $2.6 million per year required to upgrade MLGW's capabilities. This adds about $0.5/MWh to the calculated procurement cost between 2025 and 2039.

[12] See for example Siemens Draft IRP, Exhibit 22, page 28, which shows $53 million in levelized annual payments in lieu of taxes lost under Portfolio 9.

related to the current and future basis for PILOT, it is generally the case that PILOT is based on ownership of infrastructure assets (and very broadly speaking are substitutes for property taxes). Hence, whether or not the TVAs payments would disappear (or diminish) after the end of a power supply agreement depends on whether or not the level of infrastructure assets otherwise subject to local taxes would diminish or disappear. This likely largely depend on the future of the Allen plant, which is the TVA's major asset in Memphis. Should the TVA continue to own and operate the Allen plant, it would seem likely that some continued payment in lieu of taxes would be made, thus lowering the revenue loss estimated by Siemens accordingly. Also, if, as a result of a new power supply structure independent of the TVA, MLGW made investments in additional infrastructure in Memphis (such as building new plants), this would likely indeed result in additional payments in lieu of taxes. However, from the perspective of the city and its residents, such incremental payments would not represent costs, but rather transfers from ratepayers to residents – and given that ratepayers and residents in Memphis are identical (given that MLGW is a municipally owned utility), in total these payments should not be considered a net cost of canceling the current TVA power supply agreement. Hence, the magnitude of having to make up payments in lieu of taxes currently being made by the TVA in case of a separation from the TVA depend mostly on the future of the Allen plant and could be significantly lower than estimated by Siemens if the Allen plant continues to be operated.[13]

4. Conclusions

In summary, our review of the Siemens Draft IRP suggests that differences in calculated potential cost savings are NOT primarily driven by differences in assumptions about the costs of the alternative sources of power supply that MLGW could rely on in the absence of a TVA power supply contract.

Rather, the differences are driven by a) an assumed higher share of renewables than the portfolios Brattle had analyzed; b) a questionable projection of the future costs of staying with the TVA that is substantially below the current cost to MLGW under the existing TVA contract; c) the questionable assumption that payments in lieu of taxes currently being made by the TVA would entirely disappear without a TVA supply contract even though in all likelihood these payments are based on locally owned assets that would otherwise be subject to local property taxes and which would only disappear if the assessed value of those assets also disappear; and finally d) costs not analyzed by Brattle such as increasing organizational capacity at MLGW, incremental transmission investments needed to also meet reliability requirements (and not analyzed by Brattle).

---

[13] We do not have information on the basis for assessing the PILOT. To the extent the TVA owns other assets than the Allen plant, future tax or PILOT revenues absent a TVA contract will depend on whether or those assets themselves would disappear. If they would not, then a future owner would have to pay either property taxes or PILOT. This is also true if MLGW acquired such assets, but presumably the purchase price for such assets would reflect such payments as a cost (lowering the value of such an asset).

In summary, improving some of the more questionable assumptions made by Siemens, in particular related to the future TVA costs under the current contract and more precisely estimating any impact on PILOT, would likely substantially narrow (and perhaps more than close) the gap in estimated potential annual cost savings between the approximately $200 million per year under Brattle's more renewables focused 2024 portfolio most closely comparable to Siemens' Portfolios 5 and 9 and the potential annual cost savings estimated for those portfolios by Siemens, which, prior to adjusting for the factors just outlined, of about $150 million per year.

Memorandum

TO: MICHELLE CHAN, FRIENDS OF THE EARTH

FROM: DAVID WHITE, PHD, KENJI TAKAHASHI, ASA HOPKINS, PHD, SYNAPSE ENERGY ECONOMICS

DATE: JUNE 26, 2020

RE: DRAFT - COMMENTS ON THE MLGW DRAFT IRP AND TVA OPTIONS

Summary

The recent Memphis Light, Gas and Water (MLGW) Integrated Resource Plan (IRP) examined a wide range of electricity supply options for Memphis. The report included a number of scenarios that looked at joining MISO with various levels of self-supply, or two other scenarios of continuing with TVA. Section 1.6 of the IRP document compares the TVA options with the alternative scenarios in some detail. This memo focuses on three key issues and also discusses some related findings from the Synapse report of December 2019 that evaluated risks associated with continuing with TVA.

The key points raised in this memo are:

- Remaining with TVA is by far more costly than the other options considered.
- The TVA options have the least amount of renewable energy and are thus riskier in terms of fuel price increases.
- The TVA options have the most carbon dioxide (CO_2) emissions and thus would place Memphis more at risk in the event of more stringent greenhouse gas regulations and associated costs. Furthermore, the TVA options are not compatible with the City of Memphis climate policy.
- Although the MLGW IRP looked at some issues that were raised in our report, there are further risks associated with TVA options that could further increase the cost of those options:
    - Coal Ash Remediation Costs
    - Fossil Fuel Price Increases
    - Carbon Prices
    - Early Plant Retirements
    - Load Departures

For all of these reasons, we conclude that departing from the TVA contract represents the most prudent and cost-effective choice for Memphis.

Introduction

In May of this year, MLGW released its draft IRP ("Draft IRP") prepared by Siemens.[1] The MLGW IRP analysis evaluated a total of 13 future supply options, including two scenarios of staying with TVA, and assessed the costs and benefits of each. This memo is not a comprehensive analysis of the IRP but rather a focus on three key aspects of the results as they relate to the TVA options. Those three aspects are: (1) Total Costs, (2) Renewable Generation and (3) CO_2 Emissions.

Further, the memo briefly summarizes Synapse's December 2019 report, *Memphis and Tennessee Valley Authority, Risk Analysis of Future TVA Rates for Memphis.*[2] This report examined a number of risk factors that could further increase the costs of the TVA options. Most of the risk factors identified are still applicable to TVA and could increase the costs of the TVA options beyond those presented in the Draft IRP.

TVA Options Analyzed in the IRP

The MLGW IRP looked at two TVA options that differ in their contract terms. The Base option represents the renewal of the existing five-year contract, followed by continued renewal of five-year contracts going forward through 2039. The other scenario, called Long Term Partnership (LTP) represents the commitment to a 20-year contract with TVA. While the LTP option appears to be slightly less costly, it locks Memphis into a long-term agreement, and thus is potentially much riskier as things change in the future. Synapse's 2019 report assessed some of those potential TVA risks, which could increase costs significantly. We present a short summary of those risks later in this memo.

The LTP option represents TVA's current offering to local power companies (LPCs) that includes a rate discount of 3.1 percent.[3] However, it does not promise any rate freeze, despite TVA indicating its intent to keep rates stable for 10 years.[4] Instead, the agreement states "TVA is committed to provide Distributor power at rates as low as feasible under the Valley Public Power Model." In fact, according to the agreement, if the wholesale cost increases over a certain limit, LPCs could lose the rate discount. Furthermore, fuel costs are automatically passed through to customers in the monthly fuel cost adjustments, which are not included in any rate stability provisions. Thus, any cost increases will be passed on to its customers sooner or later.

---

[1] Siemens. 2020. DRAFT: Integrated Resource Plan Report - Memphis Light, Gas, and Water. Available at http://www.mlgw.com/about/IRPDraftDocument.

[2] Synapse Energy Economics. 2019. Memphis and Tennessee Valley Authority, Risk Analysis of Future TVA Rates for Memphis. Available at https://www.synapse-energy.com/project/tennessee-valley-authority-rate-forecast

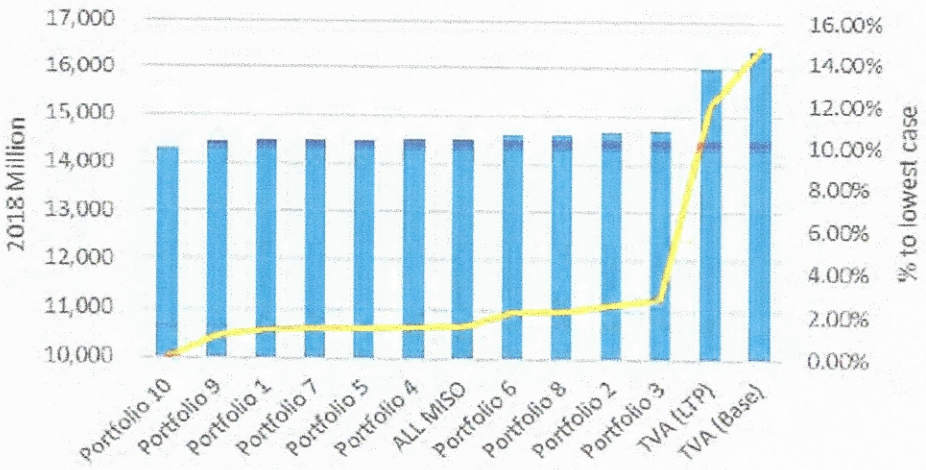
[3] TVA. 2019. Long-Term Partnership Proposal Term Sheet, TVA Discussion Draft 07-31-19.

[4] Flessner, K. 2019. "TVA offers rebates to local power companies that sign long-term contracts with TVA," *Times Free Press*, August 22, 2019.

Costs and Rates

The Draft IRP found that the two TVA scenarios were by far the most expensive ones—being 12.0 percent (LTP) and 14.7 percent (Base) more expensive than the least-cost scenario. The next most expensive option, Portfolio 3, was only 2.8 percent more expensive than the least-cost option. The TVA options are the outliers in terms of cost. This is clearly shown in Exhibit 157 of the IRP document where the orange line corresponding to the right axis shows the percent increase above the lowest cost choice.

Figure 1. Net Present Value Revenue Requirements 2020–2039



Source: MLGW IRP, Exhibit 157.

Although the MLWG IRP is an independent assessment in many ways, the IRP used TVA projections for many of the TVA cost inputs, as indicated in Exhibit 144 of the IRP. The IRP excluded several factors such as fuel price forecasts. A more complete analysis would have independently determined those inputs, including capital costs.

The Draft IRP took a bottom-up approach to estimate net present values of revenue requirements over the next 20 years for the TVA options, relying on a mix of independent and TVA-provided inputs. The Draft IRP then estimated levelized rates of the Base TVA option using the revenue requirement and the long-term sales projection. The resulting estimated levelized rates are about 5 percent lower than the current TVA rate for MLGW; yet the Draft IRP does not explain any reasons for this difference.[5] There is a possibility that the Draft IRP underestimated the cost of the TVA options. However, the Draft IRP does not provide sufficient information for stakeholders to properly assess the reasonableness of the estimates.

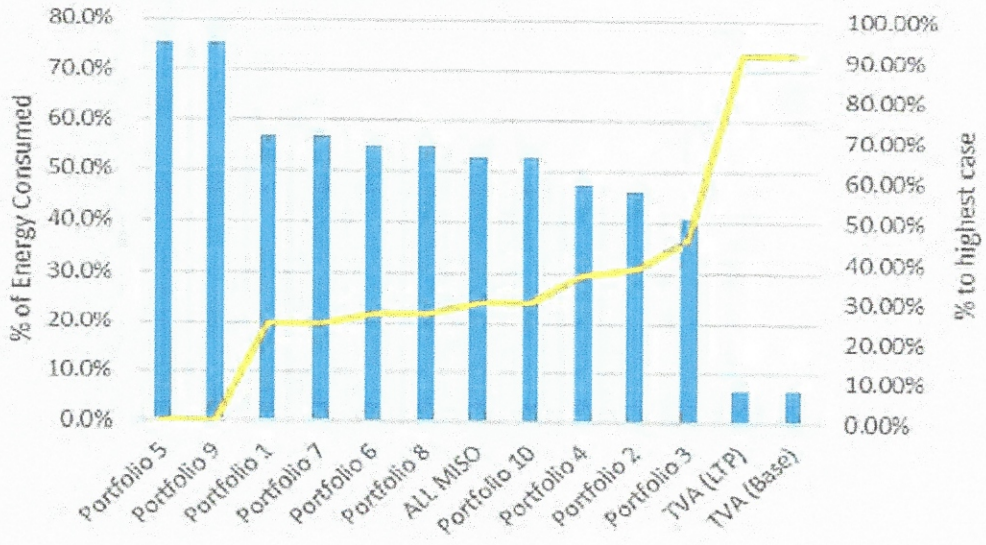
[5] The Draft IRP reports the TVA rate for MLGW as $74.45 per MWh in 2019 (Page 194). The Draft IRP estimates the 20-year levelized cost of the TVA option to be $69.21 ($2018) (Exhibit 153); this is $70.66 per MWh in 2019 dollars.

Regardless of this potential cost reduction relative to current TVA rates, the main finding regarding the TVA options is clear: they are the most expensive options. The levelized energy cost for the other scenarios is much lower, in the range of $60 to $61 per MWh.[6]

Renewable Energy

The TVA scenarios are outliers in other respects as well. For example, they provide by far the least amount of future renewable energy among all options analyzed, as shown in Figure 2 below. Here the bars represent the amount of renewable generation associated with each option in 2039. Portfolios 5 and 6 achieve 75 percent renewable generation in 2039. The two TVA options only achieve about 5 percent, which is much less than any of the others. The orange line represents how poorly each case performs compared to the best one. The best cases have zero values; the worst (the TVA ones) are more than 90 percent behind the leaders. Nearly all forecasts of future energy supply mix project ever increasing amounts of renewable energy in the future in the United States and around the world, similar to many of the other MLGW scenarios. The TVA scenarios present a static picture that will fall further behind.

Figure 2. Renewable Generation Percentage 2039



Source: MLGW IRP, Exhibit 161.

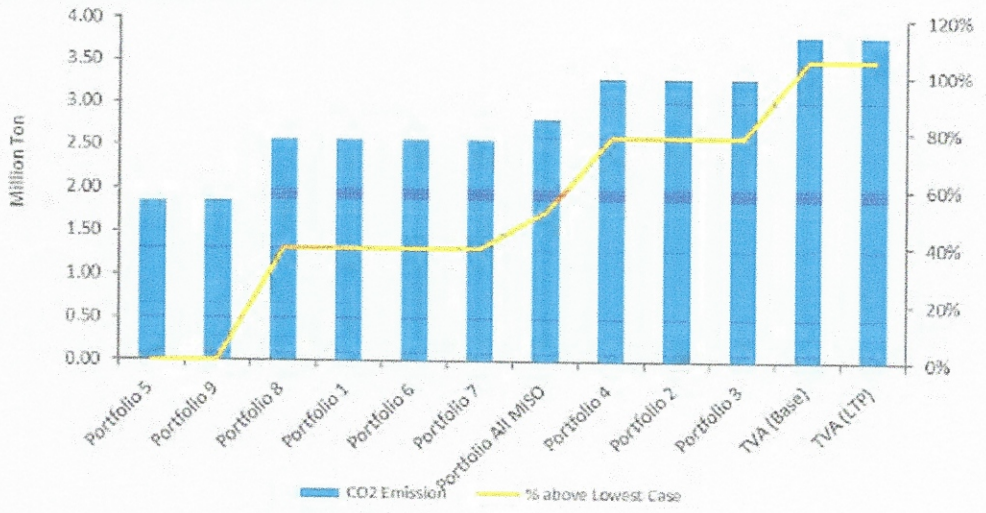
Greenhouse Gas Emissions

Another consideration is greenhouse gas emissions. Figure 3, reproduced from the IRP, shows the average annual emissions in each portfolio. Here the TVA options are the highest, with over twice the CO_2 emissions of the best portfolios. This represents both a risk and a cost. The IRP economic analysis

[6] Siemens. 2020. Exhibit 156.

included a projection of CO_2 prices.[7] The IRP uses a fairly moderate projection starting from about $4 per ton in 2025 and increasing to about $20 per ton in 2039. The upper range identified is higher, rising to $40 per ton in 2039. Other forecasts have identified the social cost of carbon to be about $100 per ton or more.[8] The average CO_2 emissions in the TVA options are about 3.75 million tons per year. A $10 per ton increase in CO_2 prices would increase the annual cost of the TVA options by $37.5 million.[9] An increase from the IRP CO_2 reference price to $100 per ton would increase the annual costs of the TVA options by about $300 million.

Figure 3. Average CO2 emissions 2020–2039



Source: MLGW IRP, Exhibit 172.

TVA Scenario Risk and Imprudence

The Draft IRP clearly shows that the TVA options are the most expensive scenarios and result in the least amount of renewable energy generation and the highest amount of CO_2 emissions among all scenarios analyzed in the IRP. These results also indicate that the TVA options are incompatible with City of Memphis's Climate Action Plan, which aims to reduce CO_2 emissions by 51 percent by 2035 and 71

[7] Siemens. 2020. Section 11.3.4. page 144.

[8] National Academy of Sciences, Engineering and Medicine. 2017. *Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide*. The National Academies Press. Available at https://www.nap.edu/download/24651#; Synapse Energy Economics et al. 2018. Avoided Energy Supply Components in New England: 2018 Report. Available at https://www.synapse-energy.com/sites/default/files/AESC-2018-17-080-Oct-ReRelease.pdf

[9] i.e. 3.75 million tons x $10/ton = $37.5 million.

percent by 2050 while achieving 75 percent carbon-free energy in electricity supply by 2035 and 100 percent carbon-free by 2050.[10]

Furthermore, much higher levels of fossil fuels and CO_2 emissions with the TVA options further increase the risks of staying with TVA. Risks associated with TVA options' greater dependence on fossil fuel power plants include increased fuel prices, CO_2 regulation, and coal ash problems. (The following section provides a brief summary of some of the key risks factors that were examined in detail in Synapse's December 2019 report.) The potential cost increases due to such risks would make the TVA options make much more expensive than found in Draft IRP. In sum, the TVA options are the most expensive and risky options and are incompatible with the City's climate policy. Thus, it would not be prudent for the City to pursue the TVA options. Instead, we conclude that departing from the TVA contract represents the most prudent and cost-effective choice for Memphis.

Other TVA Risks

In December of 2019, Synapse produced a report looking at some of the risk factors that might affect future TVA rates.[11] Although numerous risk factors were identified,[12] the analysis only quantified the potential costs for five of them: coal ash remediation, fossil fuel price increase, carbon prices, early plant retirement, and load departures. Siemens' analysis for the Draft IRP touched on some of these, but not others. Because of the terms of the potential TVA contracts, Memphis would be required to pay its share of TVA's costs resulting from any of these risks. We will briefly discuss each of the quantified risks below in the context of the MLGW TVA costs.

Coal-Ash Remediation

The remediation of Coal Combustion Residuals (CCR) represents a large potential cost for TVA. CCR is contained in a number of TVA coal facilities. Some of these have been closed, while some are intended to remain open during the life of the associated generation unit. Many of these facilities do not contain liners because they were constructed prior to the requirement that such facilities be built with liners.

TVA's current cost estimate includes the cost of treating CCR. However, many of CCR closure activities under review by TVA are closure-in-place. The 2019 Synapse report found that the cost of CCR for TVA could be $1.5 billion to $3 billion more if it were required to use more environmentally friendly methods to clean up CCR (e.g., the closure-by-removal method as used by Duke Energy or the beneficial-use

[10] City of Memphis. 2019. "Climate Action Plan," https://memphistn.gov/news/what_s_new/climate_action_plan#:~:text=Memphis%20began%20the%20climate%20action,and%2071%20percent%20by%202050.

[11] Synapse Energy Economics. 2019.

[12] Id., Executive Summary; Other Risk Factors page 18: and Appendix D, TVA Risk factors from TVA's 10-K filing.

method as used by Dominion Virginia). The Synapse report estimated the possible TVA rate impacts from coal ash to be 1.2 percent to 2.3 percent. This potential cost was not considered in the MLGW IRP.

Fossil Fuel Price Increases

TVA's generation mix in 2018 was 39 percent from nuclear, 20 percent from natural gas or oil, and 19 percent from coal. In addition, TVA purchased 13 percent of its power, the majority from gas and coal generation. The reference case for TVA's IRP indicates that the expected generation mix in 2038 will be quite similar, with a significant quantity of fossil generation. Specifically, the TVA IRP reference case for 2038 includes 9.2 gigawatts (GW) of gas combustion turbine generation, 7.3 GW of gas combined cycle generation, and 5.0 GW of coal generation. This quantity of fossil generation represents a substantial exposure to increases in fossil fuel prices.

The 2019 Synapse report estimated the possible TVA rate impacts from fuel costs to be 1 percent to 6 percent in 2028. The high end of the Synapse estimates assumed approximately $3.8 per MMBtu ($2018) for natural gas and $2.2 per MMBtu ($2018) for coal.

The MLGW Draft IRP includes a modest increase in natural gas prices and constant or declining trends in coal prices, depending on coal types (in constant dollars).[13] The reference price forecasts for 2028 are approximately $3.4 per MMbtu ($2018) for natural gas and approximately $0.7–$1.2 per MMBtu in 2028 for coal with the range representing different types of coal. Because the generation mix data for TVA is not available in the Draft IRP, we cannot directly compare these fuel price forecasts to our fuel price forecasts to assess any specific equivalent cost increase risk. However, the high end of the estimates from our study are higher than the estimates in the Draft IRP, in particular for coal prices. Further, the Draft IRP shows wide ranges from approximately –40 percent to +100 percent relative to the reference forecasts.[14] Drawing on both our 2019 analysis and the Draft IRP itself, we conclude that there are significant fuel price risks, especially for the TVA options.

Carbon Prices

As efforts increase to counteract global climate change, it is likely that a price will be assigned to carbon emissions. In 2018 TVA produced 55,500 thousand tons of CO_2 emissions from its fossil generation. This quantity will likely decrease over time with coal plant closures. In the Synapse report, we assumed a range from $5 to $22 per ton of CO_2 in 2028 to represent a range of possible policies based on CO_2 price forecasts developed in the TVA IRP. Using these values, we identified that carbon pricing reflects a potential rate risk of between 1.25 percent and 11 percent by 2028.

The Draft IRP uses a moderate carbon price in its evaluation for the reference case. The reference projection increases to $20 per ton by 2039 but is just a little over $5 per ton of CO_2 for 2028. This is less

[13] Siemens. 2020. Chapter 11 Stochastics.

[14] Siemens. 2020. Exhibit 95 through 97.

than one-fourth of our high-end estimate. The Draft IRP does not provide the assumed total TVA energy portfolio. However, if we assume the Draft IRP has the same total portfolio as we assumed in the Synapse 2019 report, the TVA options could face an upside risk of an additional 8.5 percent if carbon prices were to rise as high as $22 per ton by 2028. In addition, some analyses indicate that prices of $100 per ton or more are needed to make a real difference in combating climate change.[15] Under such a case, the TVA options would have even higher risk.

Early Plant Retirements

Over the past several years, utilities have made substantial capital investments in coal plants to meet environmental regulations, the costs of which will continue to be recovered from customers over the coming years. Future CO_2 regulations may force additional coal plants to retire earlier than expected. Further, increasing levels of cost-competitive renewable and natural gas energy generation could also lead coal plants to become uneconomic and retire.

While retiring coal and nuclear plants is often the most economical option for utilities, these assets frequently have large undepreciated balances which can lead to near-term rate impacts. Specifically, early retirement of coal or nuclear plants could result in accelerated write-offs of the remaining asset values. In the TVA IRP reference case, there are no nuclear retirements as of 2038, and coal capacity is only reduced from 7.8 to 5 GW over the same period. Accelerated depreciation of any additional retirements would increase rates in the near term for TVA's customers.

The Synapse report estimated the possible TVA rate impacts from early retirements to be 1.4 percent to 2.8 percent. This potential cost was not considered in the MLGW IRP.

Load Departures

At a basic level, electricity rates are determined by dividing total costs by electricity sales. TVA's current IRP projects that its electricity load will remain almost flat over the next 20 years. However, sales could decline, depending on a variety of factors. If costs remain the same but sales decline, rates will necessarily rise in order to collect the necessary revenue to cover fixed costs. Common reasons that sales decline are industries departing the region, customer adoption of energy efficiency technologies, and customer adoption of distributed energy resources such as behind-the-meter solar and combined heat and power. In addition, there are likely to be load reductions due to the effects of energy efficiency

[15] For example, in its February 2018 decision on requirements for Integrated Resource Plans, the California Public Utilities Commission (CPUC) found that a marginal abatement cost would of $150 per metric ton of avoided CO_2 would be required to meet the state's emissions reduction target. The CPUC therefore proposed a greenhouse gas price for planning purposes, rising to $150 per ton by 2030. *See:* California PUC, "Decision setting requirements for load serving entities filing Integrated Resource Plans," Rulemaking 16-02-007, issued February 13, 2018, at 105 and following.

programs. Furthermore, a dozen smaller LPCs are also currently considering leaving their TVA contracts.[16]

The Synapse report assumed that the penetration rate for energy efficiency and distributed energy resources in the TVA territory collectively reaches 4 percent to 8 percent by 2028. For the high-end estimate, we assumed that LPCs follow the leading utilities in the region and achieve 1 percent per year savings with energy efficiency over 10 years, with a cumulative savings of 6 percent by 2028. The Synapse report estimated the possible TVA rate impacts from load departures from energy efficiency and distributed energy resources such as behind-the-meter solar systems to be 2.1 percent to 4.3 percent by 2028.

The Draft IRP is not clear about the assumed level of energy efficiency for the rest of TVA territory. For distributed energy resources, the Draft IRP appears to have assumed the penetration rate reaches 10 percent of the TVA peak load by 2039.[17] This is the same assumption used in our analysis as the long-term penetration. The effects from energy efficiency and distributed energy resources on TVA loads appear to be considered in the MLGW IRP analysis of TVA costs, but a direct comparison is difficult. There is some possibility that TVA could lose further sales and thus experience increased average costs due to additional energy efficiency activities in the region or the departures of large industrial customers or other LPCs.

[16] Flessner, D. 2020. "TVA fights to keep its biggest customer as Memphis and other distributors eye split with utility," *Chattanooga Times Free Press*. May 27, 2020, https://www.timesfreepress.com/news/business/aroundregion/story/2020/may/27/tva-fights-keep-its-biggest-customer-memphis/523999/.

[17] Siemens. 2020. page 57.