$450M for Memphis
Public Review Comments – MLGW IRP 2020

July 6, 2020

To: Memphis Light Gas & Water
Power Supply Advisory Team
245 South Main Street
Memphis, Tennessee 38103
powersupply@mlgw.org

CC: Mayor Jim Strickland, City of Memphis
Doug McGowen, Chief Operating Officer, City of Memphis

From: $450M for Memphis

Re: Public Review Period for the Integrated Resource Plan (IRP) Comments

Attached to this letter, dated July 6, 2020, is our group's Public Review Period comments for the Memphis Light, Gas & Water Integrated Resource Plan.

Karl Schledwitz
President, $450M for Memphis

Jim Gilliland Jr.
Treasurer, $450M for Memphis

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Integrated Resource Plan comments:

1. **As of the date of this letter, July 6, 2020, which is the final day of the 30-day IRP Public Review Period, MLGW still has not acquired a "MISO-only transmission study" to determine the changes necessary to support Memphis without self-generation.**

   The IRP did not attempt to make a true "apples to apples" energy acquisition study for non-TVA potential suppliers, which the Strickland Administration asked for from the beginning. While we understand that MGLW-Siemens belatedly asked for a MISO-only analysis, MLGW has chosen not to extend the Public Review Period in order to accommodate this critical scenario. This lack of extending the Public Review Period undermines the public trust of this important exercise. Thus, the citizens and MLGW ratepayers will not have opportunity to review and comment on the only scenario that fits what the Strickland Administration originally asked for.

   Additionally, Scenario 5 of the IRP, which shows its highest savings figure, is based only a meager 31% of energy purchased on the market from MISO. The 69% balance is clearly assumed expensive and risky power plant generation supply. Again, this is NOT what the Strickland Administration asked for.

2. **Savings projections should be based on likely TVA rate increases in the future, not on artificial and unproven TVA rate reductions.**

   Information in the draft IRP confirms the concerns that have been voiced for months: The IRP is not an appropriate tool for this situation, because it makes many assumptions and then derives a "portfolio", which is uninformed by market reality and based on an inappropriate goal to have self-generation. As a result, after spending $725,000 Memphis has yet one more "study" that confirms the opportunity to save AT LEAST $150m per year, but the report says the "portfolio" and savings will need to be adjusted after an RFP is performed. The savings are understated but regardless still show at least $150m per year.

   Reference: IRP Page 31, "Siemens estimated TVA's costs will decline to about $71 MWh in the future." If TVA were unable to achieve these costs, as they are about $76 / MWh in 2019 the savings would be greater. Savings should be based on what MLGW currently pays which according to Siemens is $76/MWh. This would add $70m to the $150m projected for a total of $220 million per year.

3. **The Draft IRP confirms the savings potential shown by the previous studies, and after adjusting for items that are questionable, the magnitude agrees well with previous studies. Contrary to public statements by MLGW and TVA, the IRP states that MISO energy delivery is reliable.**

   Page 22: "From a reliability perspective all Portfolios meet and surpass NERC standards, which are among the highest in the world." This means that MISO's power can be delivered to Memphis

reliably from MISO and beyond. Therefore, we strongly believe that any questions about reliability of MISO's transmission grid is deliberate obfuscation.

4. **An RFP should be undertaken by MLGW to confirm all estimated savings before making a final decision.**

   The Draft IRP report confirms that even after spending $725,000 Memphis does not have the necessary information on market pricing to make a decision. Reference: IRP Page 27, An RFP should be undertaken by MLGW to confirm all estimated savings before making a final decision.

5. **An RFP should never be restricted to a pre-determined outcome, because no one can determine in advance what the best opportunities are going to be. Rather, an independent RFP should be performed allowing all prospective suppliers to submit proposals.**

   The stated plan to go to market with an RFP that is constrained by the "portfolio" that Siemens has arbitrarily derived based on assumptions and the self-generation direction is fundamentally flawed. By imposing a restrictive set of conditions on the RFP, Memphis will be robbed of the opportunity to see the full breadth of market opportunities and pricing.

6. **Performing this IRP before having definitive information about the market prices and options resulted in wasting time and money.**

   After a year delay and $725,000, the recommended portfolio (9) may not be feasible due to the amount of land required for solar in Shelby County, and the report itself says the portfolio lacks diversity and does not reduce CO2 emissions as much as desired.

Specific items from MLGW/ Siemens Draft IRP:

1. **Pg. 24: Market Risk**: This metric in the "Balanced Scorecard" is defined in a way that favors TVA and ignores the ability of market participants in MISO to hedge market price volatility through bi-lateral contracts. The pricing is set on these contracts and therefore the market risk is greatly reduced or eliminated.

2. **Pg. 112: Reimbursements to reconnect TVA Allen plant to TVA**? Is that in an existing agreement? Why should Memphis offer to reconnect to TVA when Memphis should request transmission interconnection and tell TVA that as long as they are interconnected there is no issue with Allen. TVA saved money when it built the Allen CC Plant by not adding TVA transmission to connect to TVA, so Memphis should feel no obligation to pay for TVA transmission addition now.

3. **Pg. 114: Existing TVA transmission interconnections with Memphis opened**? This assumption ignores previous FERC decision in East Kentucky vs TVA where FERC says transmission interconnection is not covered by TVA exemptions in FPA or TVA Act (Interconnection is not Wheeling) and FERC can therefore order TVA to interconnect.

4. **Pg. 120: MISO only transmission case: "Full steady state contingency analysis has been performed and the system is found to be reliable with no thermal or voltage violations for the summer 2025 Summer Day-Peak condition without any local generation within MLGW."** Yet even though the MISO only scenario was found to be feasible, it was **not included** for further analysis, and attention in the report was focused solely on expensive self-generation scenarios.

5. **Pg. 125: Transmission O&M**: The analysis fails to include scenarios in which MLGW would rely on a transmission company (Entergy, ATC, etc.) to build the new required lines and include the cost in a wheeling fee.

6. **Pg. 127: Other Costs: TVA Payments in Lieu of Taxes** to the state of Tennessee will only be reduced by the possible reduction in TVA total sales revenue that results from MLGW's departure. The amount of PILOT TVA must pay is set as a percentage of revenue in the TVA Act, and the distribution of the PILOT within the states is set by the state legislature, not TVA. Therefore, TVA is not legally permitted to unilaterally decide whether it will withhold PILOT payments to Memphis if Memphis is not a wholesale power customer.

7. **Pg. 177: Siemens' had pre-existing parameters on its MISO scenarios**: "Siemens prepared the transmission plan for Strategy 4 and provided it to MISO for independent feasibility review and cost estimation." This indicates the transmission outcome has been predetermined by Siemens by only asking MISO to conduct a feasibility review and cost estimation of the transmission design Siemens gave them, and not by what MISO would have done if given the opportunity to answer the question freely.

8. **Pg 187-197: TVA Status Quo**: Siemens has constructed an elaborate model to predict TVA's future power cost based on Siemens assumptions about TVA's underlying costs and Siemens projections of future trends, then assumed that under the Long-Term Partner contract, TVA magically is able to charge 3.1% less than their cost of service.

   This entire section is totally disconnected from reality. Siemens has constructed a model of TVA's costs, validated the result against only one data point (MLGW 2019 avg TVA cost) and assumed that this model will accurately predict TVA costs 20 years into the future.

   This approach is beyond ridiculous and ignores TVA's history of inefficient operation and increasing power prices. Bottom line: Siemens is saying "Trust us, even though TVA has consistently raised rates in the past and is facing high pension costs, high coal ash cleanup costs, nuclear retirements and other challenges, we built a model to show you that TVA's prices will go down in the future." Power costs and energy burden are a serious issue for the people of Memphis, and deserve a more objective assessment than this.

9. **Pg. 210: TVA scenario comparisons - The choice of 20 year timeframe for the analysis is chosen to favor TVA:** The 5-year contract notice period gives TVA an advantage because the "benefit" from the TVA proposed Partnership Contract is factored in up front, while benefits of all scenarios in which Memphis leaves TVA are delayed by 5 years. Cutting the window of consideration off at 2039 means the benefits from generation options that have lives longer than 15 years (virtually all) are not considered during the entire life of the asset.

10. **Pg. 210: Balanced scorecard rankings: These rankings of Siemens scenarios are simply a theoretical exercise**. The methodology Siemens has used, of including capital costs and calculating LCOE, etc. is fundamentally flawed because they say the assumption is that MLGW will not actually build or own any of the generation but will contract with others to build and own the generation. This means the real cost of power from these facilities (LCOE) cannot be known until the bids from developers come in after an RFP.

    Therefore, rather than this being a "comprehensive study" as promised, it is just one more expensive theoretical exercise that must be checked against the market. As people have been pointing out for months, if not years, the only way to get real market information is to go to the market with an "open" RFP that allows all proposals, all sources, all approaches and allows the broadest possible view of what the market will offer. Then and ONLY then will Memphis have the information to know what "portfolio" is the best for Memphis.

11. **Pg. 214: CO2: The IRP shows that Memphis can cut CO2 emissions in half versus TVA**. However, this reduction of only 50% is based on the assumption that TVA's generation will be replaced by natural gas. If Memphis chose to obtain some of the market purchased electricity from nuclear, hydro, solar or wind sources instead of following Siemens' path of natural gas, the CO2 emissions could be cut to a small fraction of the current TVA rate. There are also opportunities to obtain more of the electricity from renewables.

12. **Pg. 216: The fact that the IRP works to conclude Memphis should not rely on day-ahead market purchases demonstrates the lack of value being gained from this IRP**. Long before this IRP process was started, initial discussions between the Memphis City administration and MISO had already determined that MISO would not allow a member the size of Memphis to rely primarily on the day-ahead market, for a variety of reasons. It is our understanding that MLGW was invited to attend the meeting but declined to do so. Unfortunately, it appears the City has paid money to Siemens to arrive at a conclusion that was already settled.

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.

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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

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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

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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

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[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

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[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).

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[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.

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[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

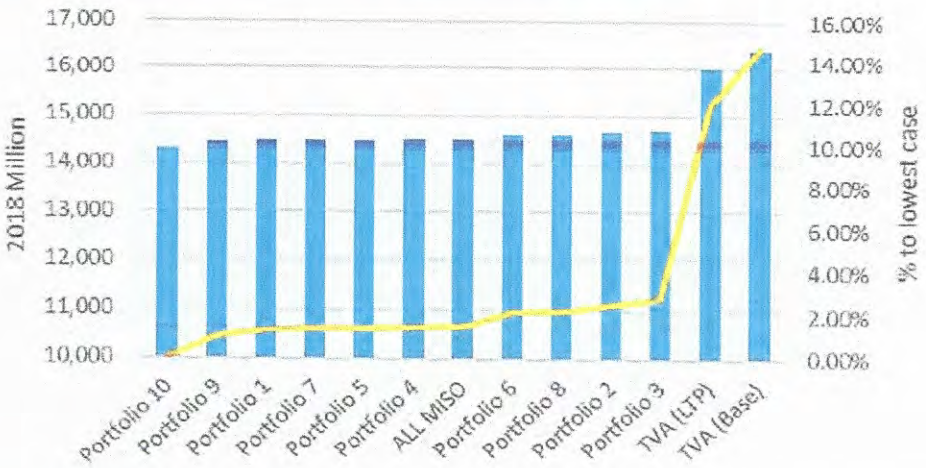
[3] TVA. 2019. Long-Term Partnership Proposal Term Sheet, TVA Discussion Draft 07-31-19.

[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.

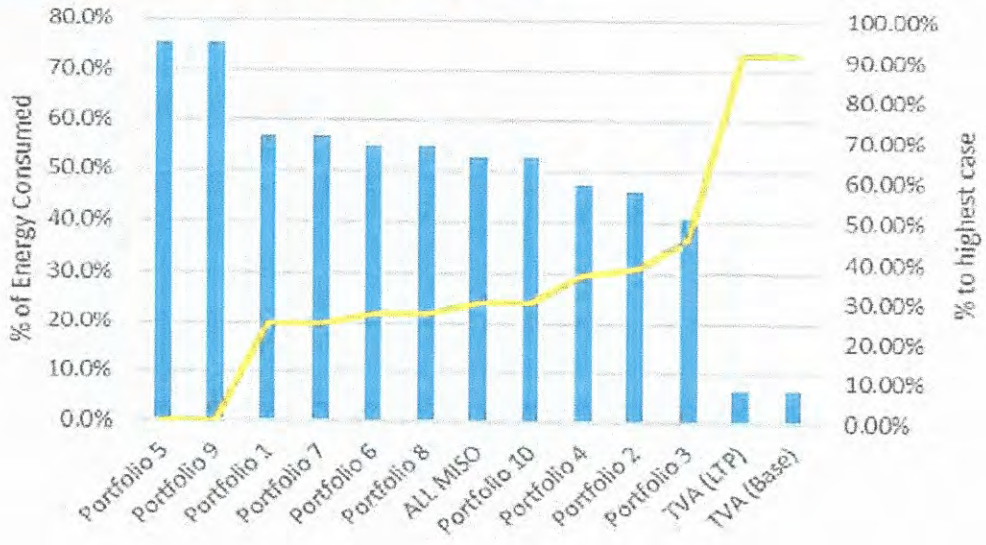
[5] The Draft IRP reports the TVA rate for MLGW as $74.45 per MWh in 2019 (Page 194). The Draft IRP estimates the 20-year levelized cost of the TVA option to be $69.21 ($2018) (Exhibit 153); this is $70.66 per MWh in 2019 dollars.

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.

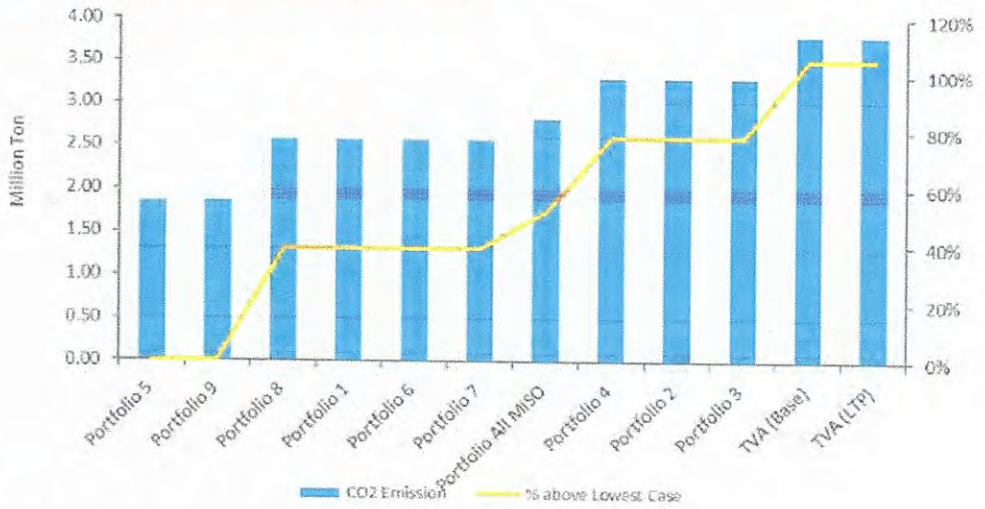
Greenhouse Gas Emissions

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

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[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.

July 2020

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SouthernRenewable.org

OVERVIEW

Renewable energy demand is growing. Renewable energy prices have plummeted over the past few years. Renewable energy prices have declined by 70-90% just since 2009.[1] In many parts of the country, renewable energy is now cost competitive against traditional energy resources. Utilities like Southwestern Electric Power Company (Louisiana/Arkansas)[2], MidAmerican (Iowa)[3], and Georgia Power[4] have announced *multi-gigawatt renewable energy power purchase agreements*. North Carolina has over 6,400 megawatts of solar power installed.[5] Corporations and other non-utility buyers are finding innovative mechanisms to directly invest in renewable energy. These voluntary announcements are due to the low costs of renewable energy.[6]

The Southern Renewable Energy Association (SREA) is a nonprofit, renewable energy industry-led initiative that promotes responsible use and development of wind energy, solar energy, energy storage and transmission solutions in the South. Our vision is for renewable energy to become a leading source of energy in the South. To achieve our vision, SREA frequently engages in integrated resource plan (IRP's) processes throughout the southeast, including the Tennessee Valley Authority's (TVA) 2015 IRP and 2019 IRP. In both efforts, SREA filed comments noting significant deficiencies in both plans that would hamper renewable energy development to the detriment to TVA customers, like Memphis Light, Gas & Water (MLGW). SREA's recommendations were not implemented in either IRP, and TVA has failed to accomplish major renewable energy development; development that its own IRPs show would reduce overall system costs and improve air quality.

SREA commends MLGW for initiating its own IRP to evaluate its energy future. Siemens' IRP analysis for MLGW corrected a number of deficiencies found in TVA's IRP and evaluated broader solutions for MLGW to reduce overall costs. Siemens also provided a high level of transparency in cost assumptions, inputs, and methodologies – a level of transparency that TVA has absconded. The overwhelming conclusion of MLGW IRP is that renewable energy resources are the lowest-cost resources for Memphis. SREA would like to provide the following comments regarding MLGW's IRP for consideration.

TVA IS FAILING MLGW

MLGW is 100% dependent on TVA for all its energy decisions. Without TVA's approval, MLGW is prohibited from engaging the free market and encouraging competition among energy providers. Similarly, whatever environmental or economic goals MLGW may wish to implement are all entirely

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[1] Lazard (November 2019). Lazard's Levelized Cost of Energy Analysis - Version 13.0. [https://www.lazard.com/media/451086/lazards-levelized-cost-of-energy-version-130-vf.pdf]

[2] Clean Technica (July 27, 2017). USA's Largest & World's Second-Largest Onshore Wind Farm (2 Gigawatt Farm) To Be Built In Oklahoma. [https://cleantechnica.com/2017/07/27/invenergy-ge-team-2-gw-worlds-second-largest-us-largest-onshore-wind-farm/]

[3] Greentech Media (August 31, 2016). New $3.6B Project in Iowa Could Be One of Many 'Mega' Wind Orders [https://www.greentechmedia.com/articles/read/iowas-new-3.6b-wind-project-could-be-one-of-many-mega-wind-orders]

[4] Georgia Public Service Commission (July 16, 2019). Commission adds 2,210 MW of renewable energy in Georgia Power 2019 Integrated Resources Plan. [https://psc.ga.gov/site/assets/files/4279/media_advisory_for_7-16-19_gpc_irp_for_web.pdf]

[5] Solar Energy Industries Association (2020). North Carolina Solar. [https://www.seia.org/state-solar-policy/north-carolina-solar]

[6] American Wind Energy Association (June 11, 2020). Wind Powers American Business Report [https://www.awea.org/resources/publications-and-reports/corporate-purchasers-market-reports/wind-powers-american-business]

contingent on TVA's nod of approval. As such, TVA has the highest responsibility to conduct fair and accurate analysis for MLGW and all other local power companies. TVA has failed to fulfill its responsibility to MLGW.

As mentioned previously, SREA was heavily involved in TVA's 2015 IRP and 2019 IRP. In both processes, SREA found significant deficiencies that hampered renewable energy development. TVA did not adequately address these deficiencies. TVA's 2015 IRP indicated a significant need for both wind and solar energy resources in the early 2020's; however, that need has gone unfulfilled. Perhaps the most high-profile failure of TVA's lack of renewable energy vision was the Clean Line Plains and Eastern high voltage direct current transmission project. That project would have intertied directly into the Shelby County substation and provide up to 3,500 megawatts of low cost, high value wind energy and solar energy resources from western Oklahoma.[7] TVA's failure was so spectacular that senior energy reporter for the Wall Street Journal, and award-winning investigative journalist Russell Gold, wrote a book chronicling the failure. In *Superpower: One Man's Quest to Transform American Energy*. Gold writes,

> "In early 2017, TVA opened a state-of-the-art $1 billion Paradise Fossil Plant in Muhlenberg County, Kentucky, running General Electric's newest, most efficient gas turbines…it used about $20 worth of natural gas for every megawatt hour of electricity. That didn't include debt payments on the $1 billion price tag or labor or maintenance….Still, TVA passed on Clean Line's latest proposal."…"Invenergy and Clean Line sent the new terms on February 2, 2017…the companies were offering to sell TVA electricity at the 'extremely compelling price' of $18.50 per megawatt hour…"[8]

Gold writes that TVA management never provided the TVA board with the updated contract prices from Clean Line, a fact corroborated by TVA board members.[9] Gold further writes that,

> "[TVA CEO Bill] Johnson said its analysis showed that Clean Line didn't save TVA any money…When I [Russel Gold] asked to see the analysis, he [Johnson] said that was impossible. I asked about what assumptions TVA made about future gas or coal prices. This too was a secret…The analysis was never shared with the board of directors – and there is no regulator that scrutinizes the TVA's decisions."[10]

After TVA's 2015 IRP went unfulfilled, a portion of Clean Line's Plains and Eastern wind project decoupled from the transmission project. That large wind project has now been approved by

[7] Clean Line Energy Partners (August 2016). Plains & Eastern Clean Line Project Overview. [https://www.energy.gov/sites/prod/files/2016/10/f33/2.%20HVDC%20Panel%20-%20Michael%20Skelly%2C%20Clean%20Line%20Energy.pdf]
[8] Russell Gold (2019). Superpower: One Man's Quest to Transform American Energy. [https://www.russellgold.net/superpower] Pgs. 241-245
[9] Russell Gold (2019). Superpower: One Man's Quest to Transform American Energy. [https://www.russellgold.net/superpower] Pgs. 241-245
[10] Russell Gold (2019). Superpower: One Man's Quest to Transform American Energy. [https://www.russellgold.net/superpower] Pgs. 241-245

regulators in Arkansas and Louisiana for delivery to the Southwestern Electric Power Company.[11] In short, another electric utility acted on TVA's failure.

In 2019, TVA conducted another IRP. TVA's draft 2019 IRP proposed effectively doing nothing for renewable energy by 2023. By 2028, TVA has just 5% renewable energy penetration, up from a current 3% penetration level. However, TVA touted its final IRP as leading to significant quantities of solar power, despite having no intention of actually implementing such a robust renewable energy portfolio.[12] Recent actions by TVA to undermine local power companies' ability to self-generate renewable energy strongly indicates that the upper management culture within TVA has not changed over the past five years.[13] In short, MLGW currently has no ability to make its own decisions, and TVA has a notoriously bad history of neglecting renewable energy development.

TVA'S FLEET IS OVERLY DEPENDENT ON EXPENSIVE COAL

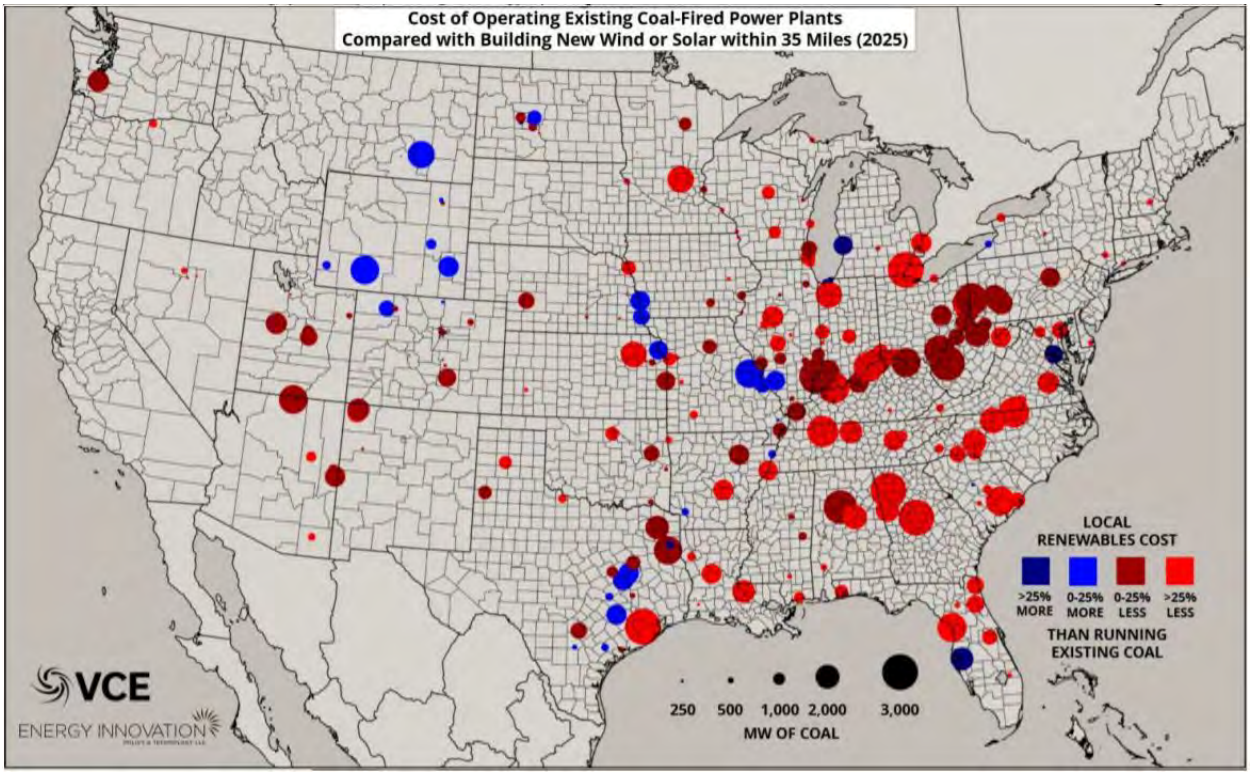
In 2019, the nonprofit organization Energy Innovation published a report entitled, "The Coal Cost Crossover: Economic Viability of Existing Coal Compared to New Local Wind and Solar Resources." This report compared existing coal-fired power plants against local renewable energy resource opportunities. TVA's natural gas and coal are all imported from out-of-state. The findings for TVA were stunning. Nearly all of TVA's coal-fired power plants are operating at costs 25% or more than renewable energy options. By 2025, almost 9 gigawatts of Tennessee-based coal resources are substantially at risk of being over-priced compared to renewable alternatives.[14] These results by an independent third-party corroborate Siemens' IRP analysis for MLGW.

[11] Renewables Now (May 28, 2020). SWEPCO gets Louisiana's nod for 810 MW wind buy, plans 200-MW solar RfP. [https://renewablesnow.com/news/swepco-gets-louisianas-nod-for-810-mw-wind-buy-plans-200-mw-solar-rfp-700472/]

[12] Stephen Smith and Maggie Shober (September 19, 2019). TVA deceives the public and the press with misleading claim of solar commitment. Southern Alliance for Clean Energy. [https://cleanenergy.org/blog/tva-deceives-the-public-and-the-press-with-misleading-claim-of-solar-commitment/]

[13] Daniel Tait (May 29, 2020). "TVA Cuts "Flexibility" Promises to Local Power Companies by 80%, Enters Into Questionable Contracts," Energy and Policy Institute. [https://www.energyandpolicy.org/tva-cuts-flexibility-promises-to-local-power-companies-by-80-enters-into-questionable-contracts/]

[14] Energy Innovation and Vibrant Clean Energy (March 2019). "The Coal Cost Crossover: Economic Viability of Existing Coal Compared to New Local Wind and Solar Resources." [https://energyinnovation.org/wp-content/uploads/2019/04/Coal-Cost-Crossover_Energy-Innovation_VCE_FINAL2.pdf]



Source: Energy Innovation 2019[15]

CORPORATIONS DEMAND CLEAN ENERGY, TVA TURNS AWAY

The American Wind Energy Association recently published a report showing many corporations are planning on achieving 100% renewable energy goals over the next five to ten years. AWEA noted this uptick in renewable energy procurement is particularly pronounced in areas that have a "wholesale electricity markets, retail choice, or green tariff program."[16] As a wholesale electricity market, MISO has enabled a number of corporate renewable energy deals. Corporation demand for renewable energy has been previously highlighted to TVA as an important component of attracting new businesses and keeping existing customers happy. Yet, TVA has dragged its feet. As Gold notes, "…Clean Line filled an appendix with letters of support from large corporations interested in expanding their operations in the TVA service area if they could purchase inexpensive renewable energy. Owens Corning…Mars, General Motors, Kellogg's, Ikea…Facebook. Honda argued that TVA could play a role as a conduit for renewable energy to surrounding utilities…The letters and proposal were sent to Bill Johnson and executives at TVA, and filed away. They were never shown to board members."[17] Currently, MLGW is effectively prohibited from developing corporate renewable energy programs.

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[15] Energy Innovation and Vibrant Clean Energy (March 2019). "The Coal Cost Crossover: Economic Viability of Existing Coal Compared to New Local Wind and Solar Resources." [https://energyinnovation.org/wp-content/uploads/2019/04/Coal-Cost-Crossover_Energy-Innovation_VCE_FINAL2.pdf]

[16] American Wind Energy Association (June 11, 2020). Wind Powers American Business. [https://www.awea.org/Awea/media/Resources/Publications%20and%20Reports/Wind_Powers_American_Business.pdf]

[17] Russell Gold (2019). Superpower: One Man's Quest to Transform American Energy. [https://www.russellgold.net/superpower] Pg. 233

MISO Offers Energy Market Competition, Renewable Energy

MISO is a nonprofit organization designed to create a wholesale power market. It does not operate like a traditional electric utility – where power plants and power lines are all owned by one entity, like TVA. MISO is a market, much like Ebay, where buyers and sellers meet to make power deals. MISO owns no power plants and owns no transmission lines. MISO operates as the platform for companies to exchange business, scheduling power flows every minute of every day from Canada to Louisiana. Power plant owners bid power into an hourly auction and MISO sorts the power offers and then selects the lowest cost power resources every hour. This power market structure allows renewable energy resources to bid in a zero operational cost, ensuring wind and solar resources are always granted first access to the grid system. Utilities and corporate buyers of renewable energy resources have bilateral contracts signed with those renewable energy projects in the MISO footprint, guaranteeing an energy price across any hour of any day from those specific renewable energy projects.

The Southern Renewable Energy Association is an official nonprofit stakeholder within MISO's stakeholder sectors, specifically the Environmental/Other Sector. SREA has participated in many of MISO's stakeholder venues, processes, and commenting opportunities. MISO recently indicated it anticipates its members are likely to achieve significant carbon reduction goals. MISO's role is to ensure its members are coordinated and working together to reduce overall costs.[18] In other words, MISO incorporates its members' plans into its overall plan, not the other way around.

MISO Transmission Expansion Plan Futures

Variables / Futures	Future I	Future II	Future III
EGEAS Ready Gross Load^			
Energy	Low-Base EV growth	30% energy growth	50% energy growth
Demand	0.63% CAGR growth rate 0.59% CAGR growth rate	1.23% CAGR growth rate 1.09% CAGR growth rate	1.91% CAGR growth rate 1.94% CAGR growth rate
Potential Load Modifiers^^			
(Technical Potential by 2040)	Technical Potential Offered	Technical Potential Offered	Technical Potential Offered
DR	5.2 GW	5.9 GW	5.9 GW
EE	13.3 GW	14.5 GW	14.5 GW
DG	14.7 GW	14.7 GW	21.8 GW
Carbon Reduction* *(2005 baseline)* MISO Footprint currently at 22%**	40%	60%	80%
Min. Wind & Solar Penetration	No minimum	No minimum	50%
Utility Announced Plans	85% goals met 100% IRPs met	100% goals met 100% IRPs met	100% goals met 100% IRPs met
Retirement Age-Based Criteria			
Coal	46 years	36 years	30 years
Natural Gas-CC	50 years	45 years	35 years
Natural Gas-Other	46 years	36 years	30 years

Figure 1: MTEP21 Future Assumptions Summary

Source: MISO 2020[19]

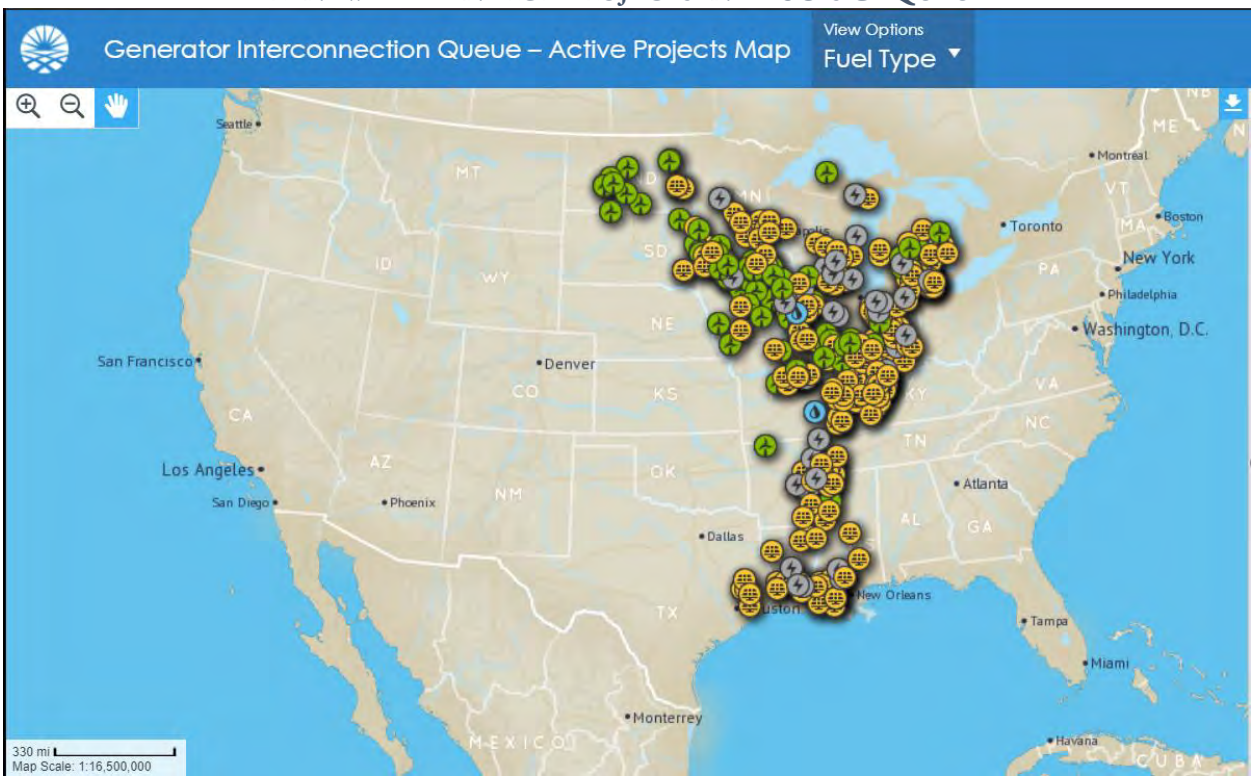
[18] Midcontinent Independent System Operator (April 27, 2020). MISO Futures Whitepaper. [https://cdn.misoenergy.org/20200427%20MTEP%20Futures%20Item%2002b%20Futures%20White%20Paper443656.pdf]

[19] Midcontinent Independent System Operator (April 27, 2020). MISO Futures Whitepaper. [https://cdn.misoenergy.org/20200427%20MTEP%20Futures%20Item%2002b%20Futures%20White%20Paper443656.pdf]

MISO South Has Significant Renewable Potential

MISO also conducts the generator interconnection (GI) process. Independent power producers that develop renewable energy projects file plans to MISO for evaluation in the GI process. MISO only evaluates a renewable energy project's *technical* viability and makes recommendations on interconnection upgrades and required improvements to protect the grid. In its GI process, MISO is agnostic to renewable energy development and is only serving as an electrical engineering role. TVA also conducts its own GI process, but in addition to the technical review, TVA also conducts its own *economic* review. In effect, TVA holds all the cards whether a renewable energy project gets built. In MISO South alone, there are over 9,000 megawatts of renewable energy projects working their way through the GI process – projects ready and able to compete in a request for proposal from MLGW.[20] If MLGW issues a request for proposals for renewable energy resources in any part of MISO, even more renewable energy projects would begin MISO GI process.

Renewable Energy Projects in MISO's GI Queue



Source: MISO 2020[21]

[20] Midcontinent Independent System Operator (2020). Generator Interconnection Queue - Active Projects Map. [https://api.misoenergy.org/PublicGiQueueMap/index.html]

[21] Midcontinent Independent System Operator (2020). Generator Interconnection Queue - Active Projects Map. [https://api.misoenergy.org/PublicGiQueueMap/index.html]

RENEWABLE ENERGY PROJECTS IN MISO'S GI QUEUE, SOUTH (MEGAWATTS)

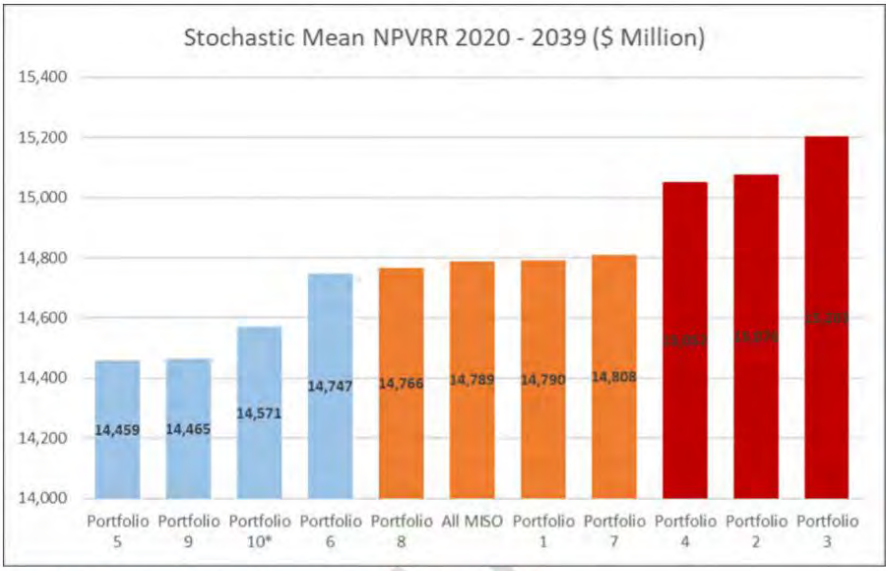
	Battery	Solar	Wind
Arkansas	160	2,694	330
Louisiana	145	4,130	
Mississippi	90	1,030	167
Texas		645	

Source: MISO May 2020[22]

REVIEW OF MLGW'S IRP

SREA has reviewed and engaged with dozens of IRP's throughout the southeast. Having had direct experience with some of the best and worst IRP's in the region, Siemens and MLGW conducted a robust IRP analysis, and deserve accolades for such an effort. Collaboration with MISO also deserves praise for its foresight and independent verification efforts. MLGW's IRP is one of the most robust and consequential in the southeast.

On a cost-basis, all ten portfolios developed by Siemens are very similar. The lowest cost portfolios are Portfolio 5 ($14.5B NPVRR), Portfolio 9 ($14.5B NPVRR), Portfolio 10 ($14.6B NPVRR), and Portfolio 6 ($14.7B NPVRR). The highest cost portfolios are Portfolio 4 ($15.1B NPVRR), Portfolio 2 ($15.1B NPVRR), and Portfolio 3 ($15.2B NPVRR). However, the cost differential between the least expensive portfolio (Portfolio 5) and the most expensive (Portfolio 3) is just 5% over 20 years.



Source: MLGW IRP 2020

The two least cost options are Portfolios 5 and 9. Both are effectively the same, except Portfolio 9 moves gas CT construction ahead of schedule to meet reliability benchmarks. Compared to Portfolios 5/9, Portfolio 10 significantly curtails renewable energy development, adds natural gas resources, and relies more heavily on MISO market purchases.

[22] Midcontinent Independent System Operator (May 2020). Generator Interconnection Queue - Active Projects Map. [https://api.misoenergy.org/PublicGiQueueMap/index.html]

Exhibit 320: Portfolio 9 Energy by Resource Type by Year

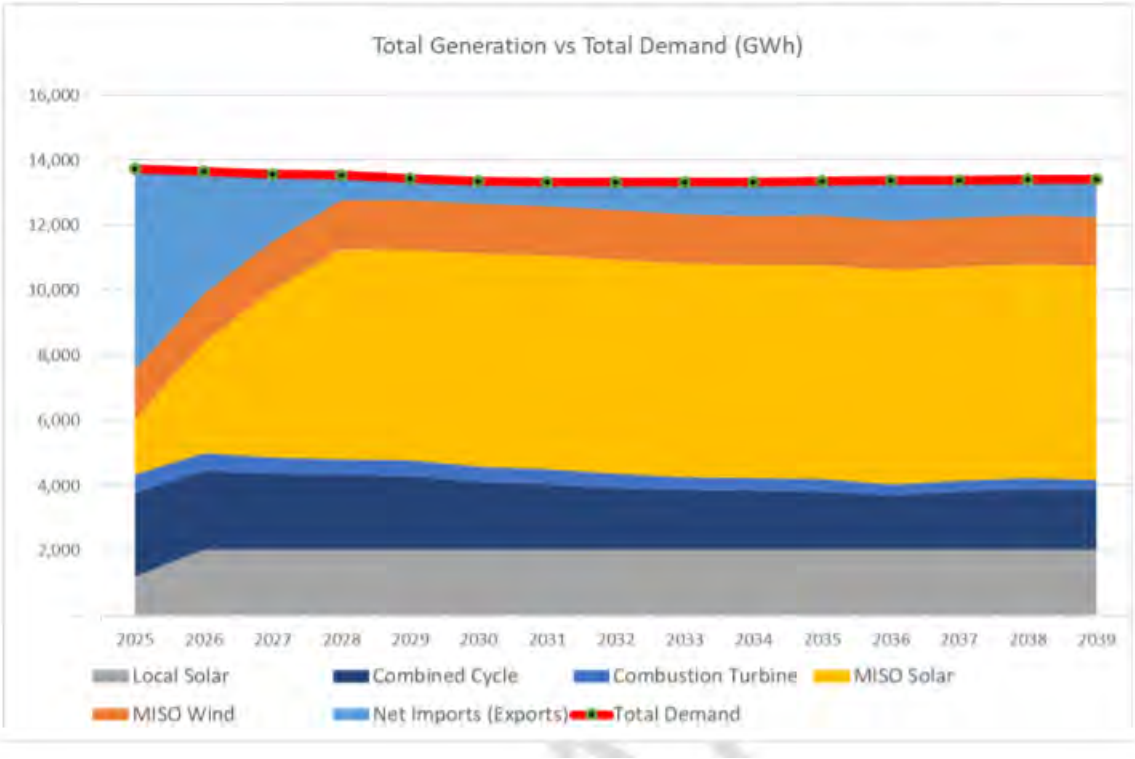


Exhibit 335: Portfolio 10 Energy by Resource Type by Year

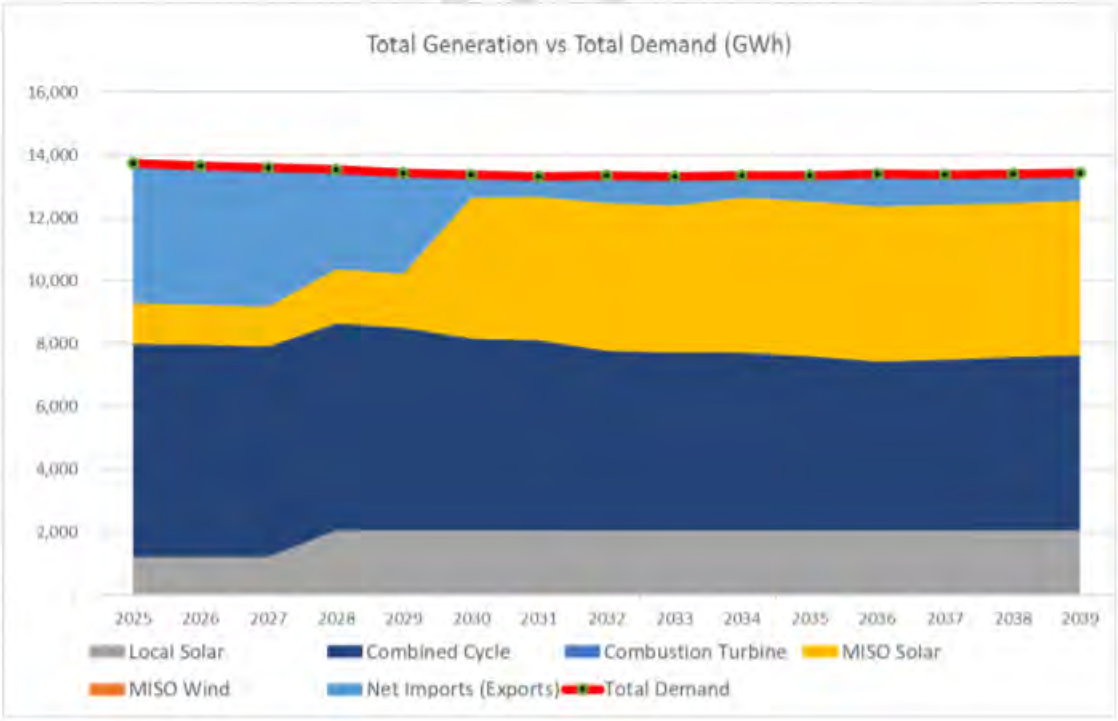


Exhibit 319: Portfolio 9 Installed Capacity by Year (Table)

	Advanced Frame CT	Convl. Frame 7FA CT	1x1 Combined Cycle	Utility Solar	Battery	Miss Solar	Arkansas Solar	Arkansas Wind	MISO_Cap	Demand
2025	0	948	450	600	0	0	800	400	1754	3197
2026	0	0	0	400	0	0	800	0	1396	3182
2027	0	0	0	0	0	0	800	0	1171	3168
2028	0	0	0	0	0	0	600	0	1012	3153
2029	0	0	0	0	50	0	0	0	977	3139
2030	0	0	0	0	0	0	50	0	976	3124
2031	0	0	0	0	0	0	0	0	993	3113
2032	0	0	0	0	50	0	0	0	968	3108
2033	0	0	0	0	0	0	0	0	999	3110
2034	0	0	0	0	0	0	0	0	1030	3112
2035	0	0	0	0	0	0	0	0	1061	3114
2036	0	0	0	0	0	0	0	0	1092	3116
2037	0	0	0	0	0	0	0	0	1123	3118
2038	0	0	0	0	0	0	0	0	1155	3121
2039	0	0	0	0	0	0	0	0	1186	3123

Exhibit 334: Portfolio 10 Installed Capacity by Year (Table)

	Advanced Frame CT	Convl. Frame 7FA CT	2x1 Combined Cycle	Utility Solar	Battery	Miss Solar	Arkansas Solar	Arkansas Wind	MISO_Cap	Demand
2025	0	0	950	600	0	0	600	0	2269	3197
2026	0	0	0	0	0	0	0	0	2262	3182
2027	0	0	0	0	0	0	0	0	2255	3168
2028	0	0	0	400	0	0	200	0	2080	3153
2029	0	0	0	0	0	0	0	0	2078	3139
2030	0	0	0	0	0	0	1200	0	1757	3124
2031	0	0	0	0	0	0	50	0	1754	3113
2032	0	0	0	0	0	0	50	0	1757	3108
2033	0	0	0	0	0	0	0	0	1782	3110
2034	0	0	0	0	0	0	100	0	1783	3112
2035	0	0	0	0	0	0	0	0	1808	3114
2036	0	0	0	0	0	0	0	0	1833	3116
2037	0	0	0	0	0	0	0	0	1858	3118
2038	0	0	0	0	0	0	0	0	1883	3121
2039	0	0	0	0	0	0	0	0	1909	3123

Siemens used up-to-date information regarding wind energy and solar energy costs and performance levels and compared its cost assumptions to the National Renewable Energy Annual Technology Baseline (NREL ATB). The NREL ATB is an industry-standard data source for generation performance and cost data across various technology types. Siemens' generation supply inputs are similar to inputs used by MISO in its Transmission Expansion Planning (MTEP) process. TVA's IRP did not use NREL's ATB, and instead relied on outdated renewable energy cost assumptions. SREA provided significant comments to TVA regarding its inaccurate data inputs, yet no changes were made to its IRP to reflect the updated data provided.[23] This partially explains why MLGW's IRP would show significant cost savings associated with adopting substantial quantities renewable energy resources, while TVA's IRP shows relatively small amounts of renewable energy adoption.

As part of MLGW's IRP, MISO conducted its own assessment.[24] MISO's base capacity expansion plan added 1.6 GW of gas in MLGW, 1 GW of solar in MLGW, 0.5 GW of solar in Arkansas, and 0.2 GW of wind in Arkansas by 2025/2026. By 2036, the model would add another 0.6 GW of solar in Arkansas, and another 150 MW of wind in Arkansas. MLGW would receive approximately 75% of its energy from renewable energy resources.

ENERGY STORAGE MODELING IMPROVEMENTS ARE NEEDED

Based on the MLGW IRP results, it appears energy storage resources are not being adequately evaluated in the various model scenarios. Due to the newness of energy storage, IRP modeling software programs are often unable to adequately evaluate the full range of value associated with energy storage. This is an industry-wide problem, and not one specific to Siemens or its use of the Aurora modeling software program. Software programs such as PROMOD, Plexos, and Aurora all have individual strengths and weaknesses regarding energy storage modeling. For example, the Aurora program used by Siemens only evaluated hourly power flows; missing the sub-hour flexibility of energy

[23] Southern Renewable Energy Association (Spring 2019). Comments on TVA's Draft 2019 IRP. [https://www.southernrenewable.org/uploads/1/9/8/9/19892499/f-srea_comments_tva_draft_2019_irp.pdf]

[24] Midcontinent Independent System Operator (May 29, 2020). Memphis Light, Gas and Water (MLGW) Power Supply Advisory Team Meeting. [http://www.mlgw.com/images/content/files/pdf/PSAT_Meeting%20Presentation_05292020_FINAL.pdf]

storage. Thus, no firm conclusions regarding energy storage can or should be based on MLGW's IRP results at this time.

On June 4, 2020, MLGW and Siemens hosted a community meeting regarding the draft IRP. Energy storage issues were discussed. The Siemens team indicated that energy storage devices were charged during the day and discharged at night[25], which seems at odds with traditional power pricing in the MISO market. If storage devices were modeled in a fixed charge/discharge schedule, that would impact the ability of those devices to maximize revenue. Again, this can be a legacy problem associated with IRP software programs.

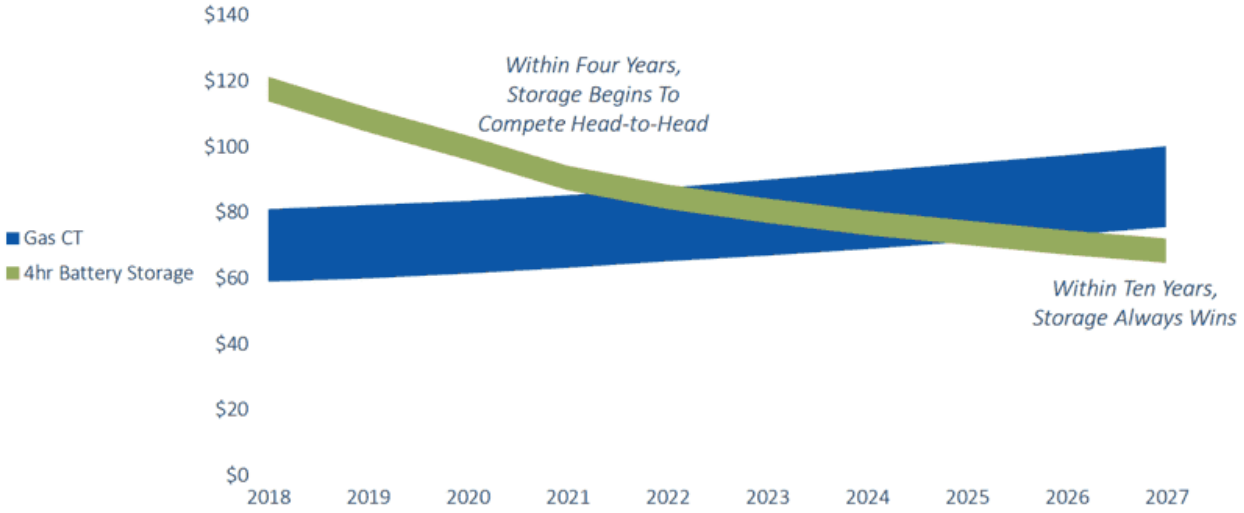
Further, forecasting energy storage value has limited data. Forecasting energy arbitrage (charging batteries when energy locational marginal prices are low, and discharging when energy prices are high), and even capacity value might have some veracity; however, energy storage resources also provide substantial ancillary services that are frequently ignored in IRP modeling, such as frequency and voltage support, ramp up and down, and synthetic inertia. Even if these ancillary services were accounted for in IRP modeling software, little forecasting data exist to account for the value of those services. In effect, energy storage can provide value that is unaccounted for in IRP modeling. MISO is working to develop some of these ancillary market products, but very little clarity exists at this time to create conclusive forecasts. MLGW would need to work with its contractors and partners to create a framework to properly evaluate the full value stack of energy storage devices, to ensure that MLGW is not unintentionally missing opportunities.

CONSIDER MODELING NATURAL GAS AS A SHORT-TERM RESOURCE

At a presentation given by GTM Research in 2018, cost forecasts for energy storage showed that within ten years, energy storage would always be the cheaper option compared to new combustion turbine gas units. Given that energy storage prices are plummeting at an increasingly rapid pace, new-build natural gas units may not have the traditional 30-40 year life expectancies that most utilities traditionally assume. Instead, as a sensitivity, natural gas power plants should be modeled in IRP's as a 10-year asset.

[25] Siemens (June 4, 2020). Community Meeting. [https://youtu.be/oOQHkJ7RhuE?t=6026]

WHEN WILL ENERGY STORAGE REPLACE PEAKER PLANTS?



Source: GTM 2018[26]

Perhaps surprising, natural gas prices have actually started to increase during the pandemic. Oil rigs frequently co-produce natural gas. For the past several years, oil prices were high enough to sustain production and co-production of natural gas, which led to an oversupply of natural gas resources, thus pushing natural gas prices lower and lower. In some cases, natural gas prices were allowed to go negative, because oil prices were high enough to sustain those losses.[27] However, as oil prices plummeted into negative territory, oil rigs that co-produce natural gas and oil were shut-in to stop the flow of oil, which concurrently stopped the flow of gas from those wells. As pure-play natural gas wells become less common, co-producing oil with natural gas is a losing prospect for drillers. Thus, natural gas prices have increased during the pandemic due to a shortening supply.[28] SREA is providing this comment as contextual information for MLGW to consider regarding future gas prices and its long-term risk of relying too heavily on this resource.

ADDITIONAL MISO TRANSMISSION SOLUTIONS MAY EXIST

MISO is evaluating transmission upgrades that would enable better power flow between MISO North and MISO South. Currently, power flow between the two regions is constrained by physical and financial limitations. Siemens evaluated numerous configurations for MLGW's IRP, with the least-cost strategy relying on a mixture of local generation and MISO-connected resources. Another "All MISO" portfolio was developed. These two portfolios are not substantially different in NPV costs, with the Full MISO portfolio being slightly higher in cost. There are important considerations that

[26] GTM Research (March 1, 2018). Will energy storage replace peaker plants? [https://event.on24.com/eventRegistration/EventLobbyServlet?target=reg20.jsp&partnerref=UtilityDive&eventid=1588963&sessionid=1&key=D819B894CB820C7457242C81A9C81644&regTag=&sourcepage=register]

[27] Reuters (May 22, 2019). US Natural Gas Prices Turn Negative in Texas Permian Shale Again. [https://www.reuters.com/article/us-usa-natgas-waha-negative/u-s-natural-gas-prices-turn-negative-in-texas-permian-shale-again-idUSKCN1SS1GC]

[28] S&P Global Platts (June 10, 2020). Analysis: Natural gas supply from Oklahoma to Upper Midwest plummets over past month. [https://www.spglobal.com/platts/en/market-insights/latest-news/natural-gas/061020-natural-gas-supply-from-oklahoma-to-upper-midwest-plummets-over-past-month?utm_source=energy+news+network+daily+email+digests&utm_campaign=5fa6bb50b8-email_campaign_2020_05_11_11_39_copy_01&utm_medium=email&utm_term=0_724b1f01f5-5fa6bb50b8-89279527]

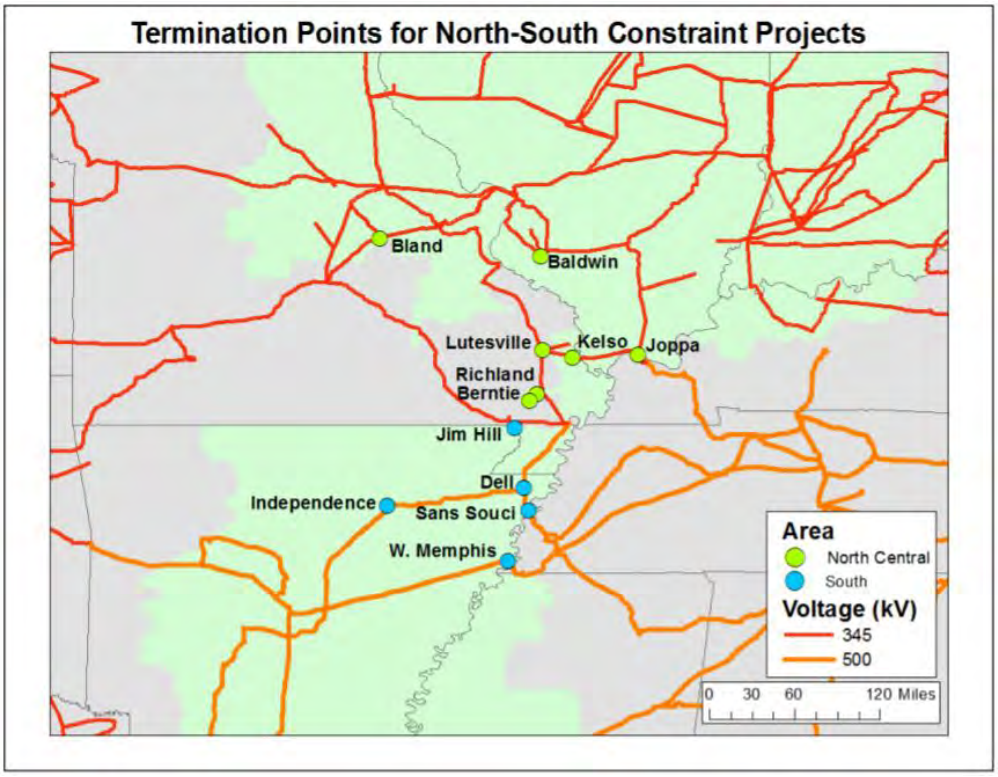
Siemens and MLGW may have not accounted for in the Full MISO portfolio that could reduce the costs, and risks, associated with that option.

For example, the MLGW IRP suggests building 950-1,824 MW's of new natural gas generation, either locally, or elsewhere in MISO South. Better connection with MISO North may enable MLGW access to a more diversified portfolio of market opportunities, and already-existing generation at a lower cost than self-building new generation; avoiding the construction of new 30+ year natural gas assets. Accessing shorter-term and lower-cost resources from MISO North would avoid risks associated with large capital expenditures of potentially stranded natural gas assets in the very near future.

Both Portfolio 9 and Full MISO require some significant transmission upgrades to adequately connect Memphis to the MISO system. However, there may be cost *allocation* savings to the Memphis system if those more significant transmission upgrades also align with MISO's goal of better connecting MISO North and MISO South. In June 2019, the Organization of MISO States Board of Directors approved a list of principles for long-range transmission planning. Principle 3 states, "The long-range planning must develop and assess cost-effective solutions to known physical and contractual system constraints, including the Regional Directional Transfer Limit (i.e. ***the north-south constraint***)."[29] The MISO North/South seam has been a problem for MISO for a number of years, and some top solutions are estimated to cost the MISO system $152-$262 million.

MISO's cost allocation methodology shares transmission costs among benefiting entities based on a cost benefit analysis and a "beneficiary pays" principle. Principle 7 states, "Cost allocation, ***based on beneficiary pays***, is a critical and necessary aspect of long-range transmission planning and development." Memphis' joining the system could lead to a more robust connection between the North and South, reducing the cost to MISO members to upgrade that seam *and* reducing the transmission costs for Memphis to interconnect to MISO, while enabling Memphis better access to market power beyond Arkansas.

[29] Organization of MISO States (June 13, 2019). Organization of MISO States Statement of Principles re Long-Range Transmission Planning. [https://www.misostates.org/images/20190613_Long-Range_Transmission_Planning_Principles_-_Approved__Combined.pdf]



Source: MISO 2019[30]

POTENTIAL MISO NORTH/SOUTH INTERTIE SOLUTIONS

New Transmission Solution	Rating (MVA)	Cost (2019-$M)	20-yr B/C ratio aggregate
Jim Hill – Berntie 345kV	2574	152	2.04
Jim Hill – Lutesville 345kV	2574	249	1.16
Jim Hill – Kelso 345kV **Jim Hill – Berntie 161kV**	2302	262	1.10
Joppa – Sans Souci 500kV*	2229	542	0.73
Joppa – W. Memphis 500kV*	2229	738	0.53

Source: MISO 2020[31], *MISO 2019[32]

Three new transmission projects would be required to integrate Memphis into the MISO system, including a 500kV line from San Souci to Shelby, a 500kV line from West Memphis to New Allen, and a 230kV line from Twinkletown to New Allen. Siemens estimated these transmission upgrades, stating "Therefore, the total estimated transmission capital expenditure is approximately $696.5 million, or $2.11/MWh of 2025-2039 NPV assuming 30-year repayment schedule for the Base

[30] Midcontinent Independent System Operator (July 25, 2019). MTEP19 Market Congestion Planning Study (MCPS) Screening Results for the North-South Constraint Focus Area, MCPS TSTF. [https://cdn.misoenergy.org/20190725%20MCPS%20TSTF%20Item%2002c%20MTEP19%20North-South%20Screening%20Results_reposted366407.pdf]

[31] Midcontinent Independent System Operator (May 27, 2020). MTEP19 MCPS NorthSouth Interface Focus Area Conclusions. [https://cdn.misoenergy.org/20200527%20MCPS%20TSTF%20Item%2003%20North-South%20Interface448455.pdf]

[32] Midcontinent Independent System Operator (July 25, 2019). MTEP19 Market Congestion Planning Study (MCPS) Screening Results for the North-South Constraint Focus Area, MCPS TSTF. [https://cdn.misoenergy.org/20190725%20MCPS%20TSTF%20Item%2002c%20MTEP19%20North-South%20Screening%20Results_reposted366407.pdf]

Strategy 3 investments."[33] Transmission projects tend to be 40+ year assets, lowering the overall annualized cost. For a Full MISO portfolio, Siemens added another transmission project, a 500kV line between Dell-MISO to Shelby-MLGW with two new transformers. Estimated cost for this upgrade would be $248.3 million, a cost fully allocated to MLGW by Siemens' analysis.[34] In short, if MISO and MLGW conducted another study, and included assumptions regarding regional cost allocation, a MISO North/South intertie solution may be highly valuable to both MLGW and MISO.

Memphis' interconnection with MISO, if also tied to improving the North/South seam, would be mutually beneficial for MLGW and MISO. Previously, MISO has studied improving its North/South seam with several different options, including improved connection with to the Sans Souci substation – the same substation identified by Siemens as a key interconnection point for MLGW. MISO's analyses have previously shown a more robust transmission solution between Joppa (southern Illinois) directly to West Memphis; however, those solutions did not result in a net cost benefit – potentially because those solutions did not incorporate the likelihood of Memphis paying for a portion of those transmission projects. Similarly, the Siemens IRP analysis likely did not evaluate this more robust Joppa to West Memphis costs as being cost-shared with MISO. Because other MISO stakeholders would see cost savings associated with the Joppa to West Memphis project, those other entities would also pay to construct the project – a cost savings not considered by Siemens. Robust study by MISO and MLGW would be necessary to evaluate this opportunity.

HVDC options should also be evaluated for interconnection purposes. Smaller and shorter-distance transmission projects do not suit HVDC use; however, linking together several smaller projects together into an individual larger project would make HVDC options more economically feasible. MISO stakeholders[35] have noted limitations in MISO's transmission expansion planning software and modeling problems that do not adequately evaluate HVDC options, limitations that potentially apply to MLGW's IRP.

[33] Siemens (May 29, 2020). Transmission Assessment for MLGW IRP. [http://www.mlgw.com/images/content/files/pdf/Siemens%20PTI%20RPT%20MLGW%20IRP%2020200529_web%202%20of%203.pdf]

[34] Siemens (May 29, 2020). Transmission Assessment for MLGW IRP. [http://www.mlgw.com/images/content/files/pdf/Siemens%20PTI%20RPT%20MLGW%20IRP%2020200529_web%202%20of%203.pdf]

[35] Midcontinent Independent System Operator (February 24, 2020). Feedback was received for: MCPS: N-S Focus Area Robustness Testing (20200128). https://cdn.misoenergy.org/20200527%20Stakeholder%20Comments%20on%20N-S%20Constraint447983.pdf

RECOMMENDATIONS

MLGW's IRP suggests that the best performing portfolios may save approximately $1.5 billion over 20 years, compared to staying with TVA while delivering a cleaner, more consumer-friendly energy mix. The best performing portfolios have substantial renewable energy resources developed, reducing costs, creating jobs, and improving climate metrics. In order to ground-truth the results of its IRP, MLGW should immediately begin the development and issuance of an all source request for proposals (RFP). All source RFP's are now industry standard in the utility industry and enable utilities to accurately compare various proposals across numerous metrics.[36] SREA recommends issuing a draft RFP for comment prior to issuing the final RFP, which would enable stakeholders to provide recommendations on improvement. MLGW may wish to issue several rounds of RFPs to allow new projects enough time to enter into the MISO queue and subsequently file a proposal with follow-on RFP rounds. MLGW should also re-engage with MISO to evaluate the North/South seam issue as a new potential path for energy and capacity resources. SREA commends MLGW and Siemens on its IRP and we are available to assist in any way possible.

[36] John Wilson, Mike O'Boyle, Ron Lehr, Mark Detsky (April 2020). Making the Most of the Power Plant Market: Best Practices for All-Source Electric Generation Procurement. [https://energyinnovation.org/wp-content/uploads/2020/04/All-Source-Utility-Electricity-Generation-Procurement-Best-Practices.pdf]