Memphis Light, Gas and Water

Long-Term Portfolio Considerations

January 31, 2019

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DISCLAIMER

1. Executive Summary

This report assesses potential power supply savings for the City of Memphis. There is a potential opportunity for the City of Memphis to save an estimated $9.2 billion between 2024 and 2038 if Memphis Light, Gas and Water (MLGW) chooses to self-supply its electricity needs beginning in 2024 rather than staying in the current all-requirements contract with the Tennessee Valley Authority (TVA). ACES has not reviewed and has no legal opinion on the ability of MLGW to exit its TVA contract, the implications of the TVA Act, or any other contracts governing the relationship between MLGW and TVA.

Assuming the opportunity exists to change power supply strategies beginning in 2024, the potential annual savings range from $413 million in the first year to $817 million by the end of the study (2038), totaling $9.2 billion over the 15-year period. Figure 1 below compares the current TVA cost for wholesale electric supply (2018 rate for demand and energy), escalated at 2.1% (historical growth rate) annually with the expected power costs from self-supplying a power supply portfolio under current market conditions and capital costs. Figure 2 below provides the range of total potential savings given the expected self-supply costs and a range of TVA rates.

Figure 1.

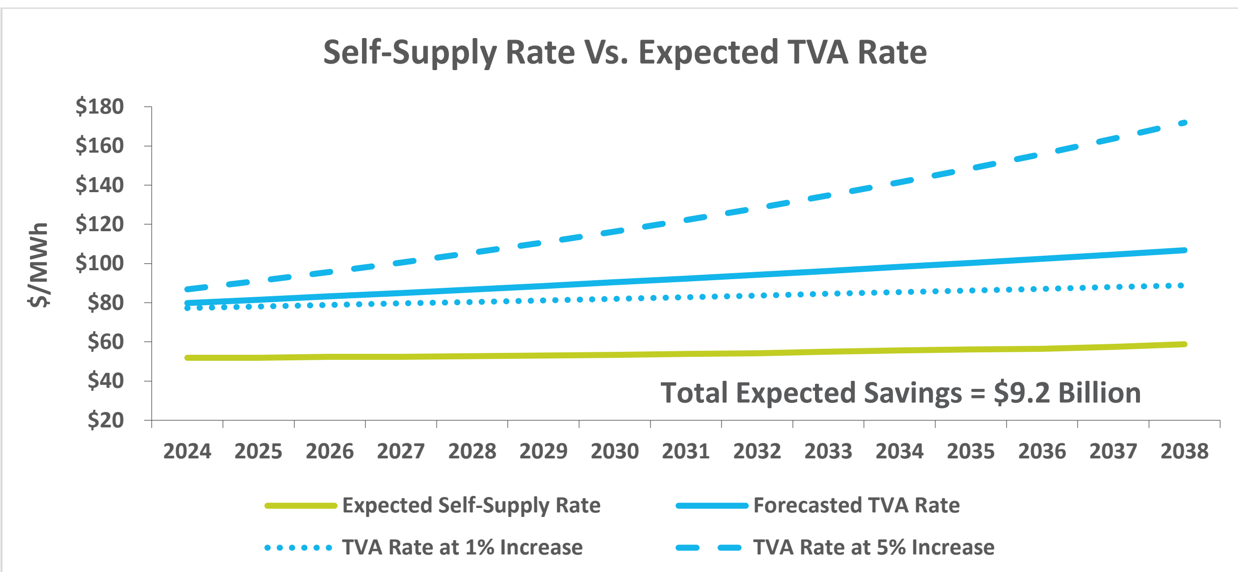


Figure 2.

Total Expected Savings From Self-Supply Rates vs. TVA Rates		
1% TVA Rate Increase	**2.1% TVA Rate Increase**	**5% TVA Rate Increases**
$6.8 Billion	$9.2 Billion	$17 Billion

To arrive at this savings estimate, ACES completed an analysis of 20 different future power supply portfolios. This analysis aimed to identify benefits of MLGW developing its own power supply portfolio versus staying with the current all-requirements contract with TVA. Of the 20 potential future power supply portfolios, ACES selected a single sample portfolio with realistic costs and characteristics for this report. ACES assumed MLGW will join the Midcontinent Independent System Operator (MISO) Regional

Transmission Organization (RTO) to maintain the same level of reliability as TVA, to have transmission access, and to have wholesale market access. The report summarizes, at a high level, a step-by-step process to achieve these savings, and a broad timeline for the City of Memphis to realize the savings as soon as possible. Figure 3 below summarizes the steps in developing a self-supply portfolio and the sample portfolio utilized in the analysis.

Figure 3.

How to Build a Self-Supply Portfolio			
Step	**Portfolio Need**	**Sample Portfolio**	**Portfolio Energy %**
Step 1	Market Access	MISO	7%
Step 2	Baseload Supply	1,000 MW Market Purchase	51%
Step 3	Intermediate Supply	900 MW Combined Cycle	13%
Step 4	Renewable Supply	1,000 MW Solar + 500 MW Wind	25%
Step 5	Peaking Supply	650 MW Quick Start Peaking	4%

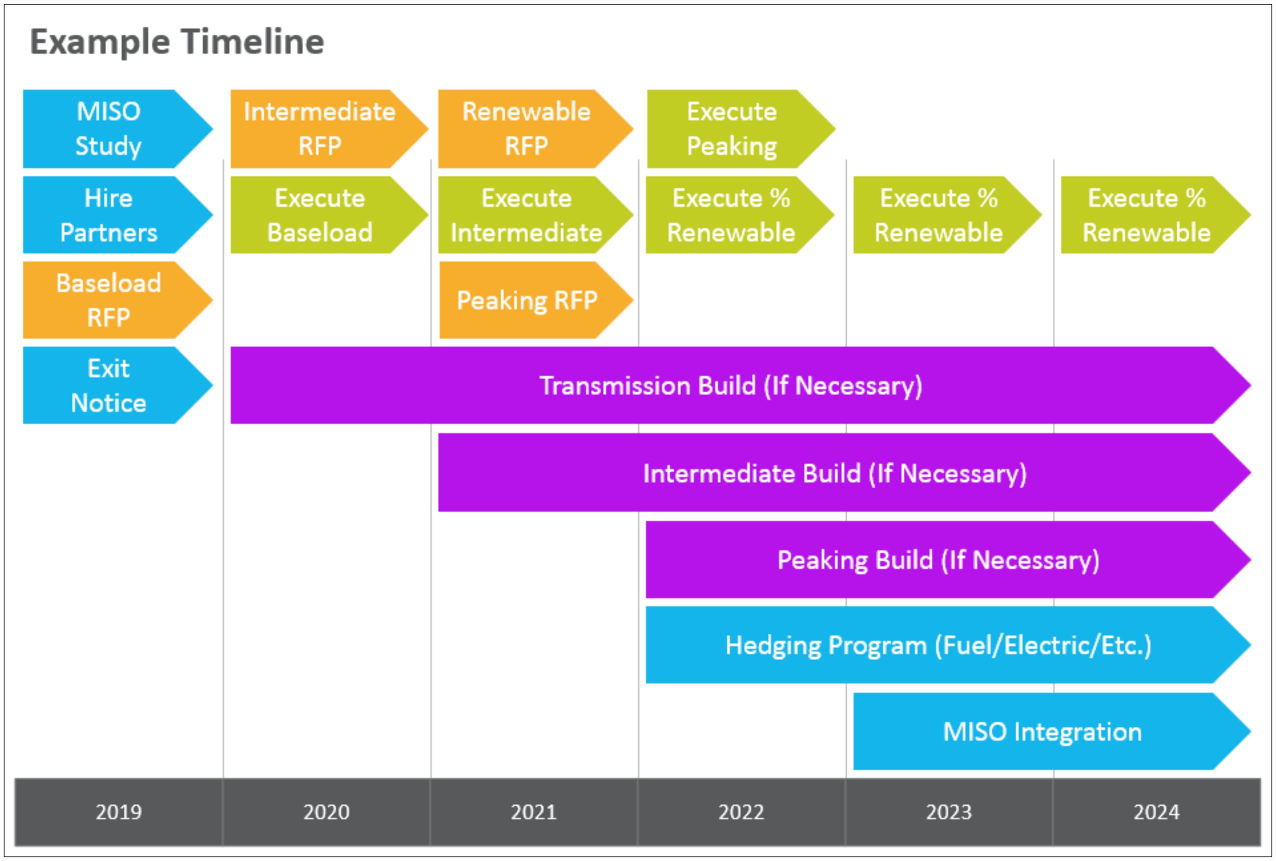
In addition to the $9.2 billion in potential savings, there are other considerations MLGW has to contemplate with regard to its future with TVA, including the following:

- TVA Privatization
  - The political and regulatory risks TVA faces with potential privatization
- Carbon Legislation
  - More drastic potential regulation on coal generation, including potential carbon costs
- Nuclear Costs
  - Costs of nuclear energy increase as plant retirements increase and waste disposal costs become more uncertain
- Power Supply Strategy
  - There are advantages of being self-sufficient; MLGW is largely tied to whatever power supply mix TVA chooses today
  - If MLGW desires a high renewable portfolio standard, there is more opportunity with self-supplying and joining an RTO that has a diverse footprint, such as MISO
- Other TVA Wholesale Customers Leaving
  - If other TVA customers employ a self-supply strategy before Memphis, stranded costs will likely be shifted to Memphis and TVA rates will increase more rapidly than they have historically

If MLGW chooses to continue pursuing a self-supply option, the next step includes a full cost benefit analysis from MISO. This analysis will provide a more detailed account of the necessary transmission upgrades, potential administrative fees, and insight into how the market views the reliability of the transmission grid in the area. Furthermore, if MLGW determines the goals for a self-supply portfolio, a service provider can issue a non-binding Request for Proposals (RFP) on MLGW's behalf to determine specific suppliers willing to provide baseload power to MLGW, and can analyze the responses for fit and costs. Finally, MLGW needs to have a thorough understanding of costs or other deterrents related to exiting its all-requirements contract in the TVA balancing authority; however, the expected savings of $9.2

billion will likely outweigh potential costs associated with leaving TVA. A high level timeline of pursuing a self-supply portfolio is outlined in Figure 4 below.

Figure 4.



2. Assumptions

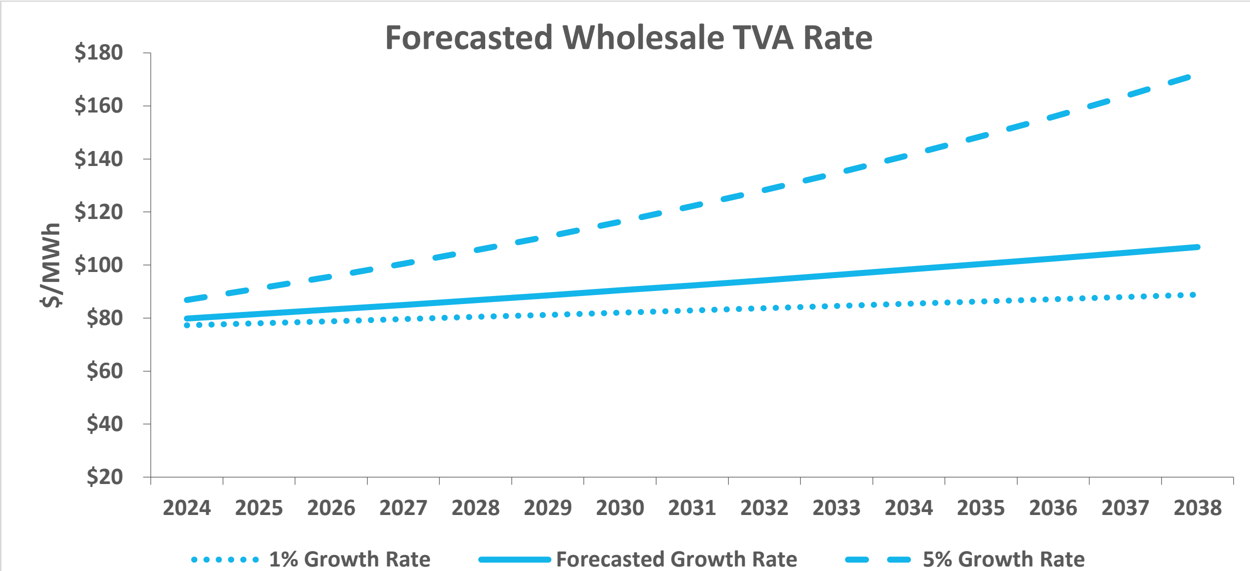
2.1. Current MLGW Wholesale Power Costs

TVA currently serves MLGW and MLGW's 421,000[1] customers, which make up TVA's largest wholesale customer base. MLGW accounts for more than 11% of TVA's load and 9% of TVA's revenue. TVA provides reliable electricity at rates recently averaging near $70/MWh[2] (total annual cost of just over $1 billion). The TVA rate includes energy, capacity, transmission, reliability, and the cost of following MLGW's total demand every hour. Figure 5 on the following page highlights the expected range of rates for TVA, which are used for comparison throughout this analysis.

[1] http://www.mlgw.com/about/

[2] Based on historical growth rates 2008-2017

Figure 5.



MLGW has a five-year notice[3] out provision in its contract with TVA, meaning that the earliest MLGW could consider alternative portfolios is in 2024. For the sake of simplicity, the analyses start January 1, 2024 and runs through 2038. TVA provides actual historical rates and expected rates in the short-term. ACES then utilized an appropriate escalator based on historical rate increases and inflation to determine future rates and total costs if MLGW stayed with TVA long term. TVA's rates are forecasted to increase by an average of 2.1% annually; however, comparisons utilizing a 1% and 5% rate increase were also considered to provide a reasonable range of potential outcomes. The calculated potential total costs for TVA's rates for the entire 15-year study period falls between $20 billion and $30 billion, with an expected total cost of more than $22 billion. Specific data related to these assumptions is available upon request.

2.2. Modeling Assumptions and Setup

ACES utilized a probabilistic resource planning model and a financial model to perform the analysis to determine if it will be economic for MLGW to buy its own assets and self-manage its energy needs or continue its agreement with TVA. ACES considered the cost to build and maintain new generation for natural gas and renewable resources, such as wind and solar, and estimated the cost of potential bilateral agreements with other counterparties. ACES used publicly available information to estimate MLGW's annual peak demand through 2038, and computed the net present value (NPV) to build the resources MLGW would need to meet its demand plus 7.9% for reserves that MISO requires for a Load-Serving Entity (LSE). ACES assumed a discount rate of 6.5% to determine the NPV for each scenario. ACES used wholesale future power prices at Arkansas Hub and future natural gas prices for Tennessee Gas Pipeline to estimate the fuel cost for power generation.

[3] TVA 10-K, 2016-2018

3. Why Change Suppliers Now?

It is important to assess why it is an opportune time to make a fundamental shift in MLGW's power supply strategy.

3.1. Affordability

Wholesale power prices near MLGW are significantly below the price MLGW is currently paying TVA. Additionally, the trend in the energy market for a utility today is to reduce reliance on a single asset, contract, or supplier, as well as to seek opportunities to take advantage of the low price environment. One challenge with relying on a large utility through an all-requirements deal is their need to recoup fixed costs on a large fleet of legacy resources, particularly older and outdated resources.

3.2. Increased Access to Low Cost, Clean Energy

The next consideration is related to MLGW's ability to determine its fuel mix individually and not be subject to the decisions made by TVA and its other customers. If MLGW has a desire to reduce its carbon footprint and/or develop a high renewable portfolio standard, there is more opportunity in the MISO wholesale market. For this analysis, ACES analyzed a target of 25% of MLGW's total load to be served with renewable resources. ACES has observed 20-year contracts in MISO at $30/MWh or less for solar energy and $21/MWh for wind.

3.3. Inherent Risks in the TVA Portfolio and Business Model

The uncertain political climate poses risk to TVA and its rates to its wholesale customers. Some politicians believe TVA should be privatized. Privatization of TVA would not only cause misaligned goals between MLGW and its host utility, but investor-owned utilities (IOU) are incented to build generation and transmission to increase their rate of return for shareholders and thus increase rates to MLGW. There is also considerable regulatory risk associated with coal and nuclear generation. Items such as a carbon tax or regulation could drastically increase TVA's rate and even change TVA's structure. Finally, MLGW is likely not the only TVA wholesale customer considering alternative power supply solutions. If other TVA customers switch suppliers, MLGW may face a rate increase if it is required to pay a higher share of the remaining TVA fixed costs.

4. Power Supply Planning

Overall, ACES considered more than 20 scenarios with varying generation technologies, power purchase agreements (PPA), availability of distressed assets, renewable portfolio targets, and market exposure. Every scenario considered showed a power cost range lower than what is forecasted to be provided by TVA, but have varying degrees of risk, money locked into fixed-price contracts, and final wholesale power costs. The sample portfolio selected for this report focuses on affordability, utilizing clean energy and limiting the market risk in the portfolio. Figure 6 on the next page summarizes all the scenarios considered, including NPV metrics, clean energy targets, and market exposure. For the purposes of this analysis scenario 22 is utilized which includes a 1,000 baseload purchase, a 900 MW new build combined cycle, 25% renewable target, and 650 MW of peaking resources.

Figure 6.

Initial Portfolio Considerations					
Scenario Number	**Scenario**	**Renewable Goal**	**Market Exposure/Risk**	**15-Year NPV of Costs**	**NPV Rank**
1	TVA	No	0%	$10,427,871,355	22
2	All Market	No	100%	$5,748,866,025	5
3	First Take - Baseload + Intermediate + Solar Scenario	No	50%	$5,849,428,187	8
4	Low Fixed Cost Scenario	No	50%	$5,377,285,452	2
5	All Combined Cycle Scenario	No	60%	$6,145,174,272	21
6	Distressed Asset Scenario	No	75%	$5,567,146,480	3
7	High Capacity Exposure Scenario	No	75%	$5,810,001,439	6
8	Iteration 1 - Combined Cycle + Peaking + Renewables	No	55%	$5,699,249,229	4
9	Iteration 2 - Combined Cycle + Peaking + Renewables	No	15%	$5,972,168,718	19
10	Iteration 3 - Combined Cycle + Peaking + Renewables	25%	15%	$5,948,199,037	16
11	Iteration 4 - Combined Cycle + Peaking + Renewables	25%	15%	$5,906,058,122	12
12	Combined Cycle + Renewables	25%	15%	$6,035,756,402	20
13	Combined Cycle + High Renewables	50%	30%	$5,950,879,522	17
14	Iteration 1 - Combined Cycle + Peaking + High Renewables	50%	15%	$5,944,543,048	14
15	Iteration 2 - Combined Cycle + Peaking + High Renewables	50%	15%	$5,935,484,964	13
16	Iteration 3 - Combined Cycle + Peaking + High Renewables	50%	15%	$5,952,162,537	18
17	Iteration 4 - Combined Cycle + Peaking + High Renewables	50%	15%	$5,946,840,460	15
18	Iteration 5 - Combined Cycle + Peaking + High Renewables	50%	15%	$5,220,012,858	1
19	Iteration 6 - Combined Cycle + Peaking + High Renewables	50%	30%	$5,831,855,159	7
20	Iteration 7 - Combined Cycle + Peaking + High Renewables	50%	30%	$5,899,413,757	9
21	Iteration 8 - Combined Cycle + Peaking + High Renewables	50%	30%	$5,901,439,780	11
22	**Final Sample Portfolio**	**25%**	**15%**	**$5,900,030,101**	**10**

4.1. Step 1 of Building a Portfolio: Market Access

Figure 7.

How to Build a Self-Supply Portfolio			
Step	**Portfolio Need**	**Sample Portfolio**	**Portfolio Energy %**
Step 1	Market Access	MISO	100%
Step 2	Baseload Supply		
Step 3	Intermediate Supply		
Step 4	Renewable Supply		
Step 5	Peaking Supply		

The most reasonable alternative for MLGW if it leaves TVA is to join an RTO, specifically MISO, due to the proximity. There are many benefits to joining an RTO, including the following:

- Reliability
  - An RTO provides equivalent reliability as TVA
- Efficient Market Dispatch
  - Utilities share resources limiting the time that expensive generation is needed to serve the demand of the market
- Reserve Sharing
  - With a large diverse footprint, there is also the ability to share reserves if an MLGW generator were to go on outage
- Balancing the Grid
  - In an RTO, each member is not required to have enough generation to serve its own load; the RTO will ensure demand is met at the most economical price
- Portfolio Flexibility
  - RTOs provide opportunities to transact at trading hubs and contract efficiently from a variety of types of assets, including renewables
- Price Signals
  - Pricing signals for energy and capacity allow for prudent investment decisions in future resources and power supply contracts, the ability to trade with a variety of counterparties, and an understanding of transmission limitations on the system
- Liquidity
  - There are more power supply counterparties in an RTO due to the availability of price signals, trading hubs, and willing trade partners
- Transmission Planning
- Generation Interconnection Services
- Central Location Billing

MLGW can interconnect to the MISO system through Entergy Arkansas, LLC (see Figures 8 and 9). The cost of that interconnection process is beyond the scope of this document, but is something MLGW needs to consider.

Figure 8. [4]

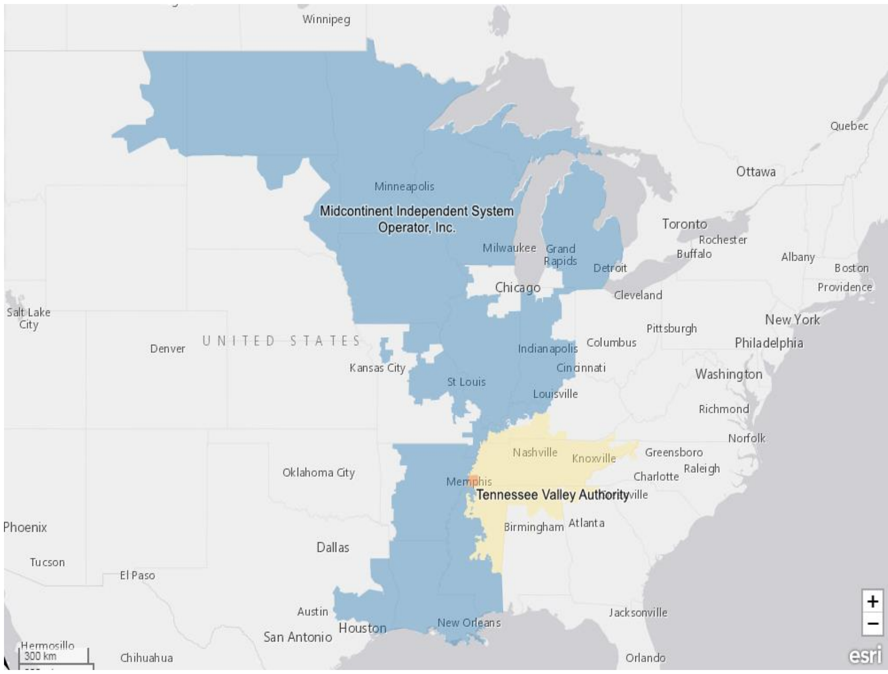
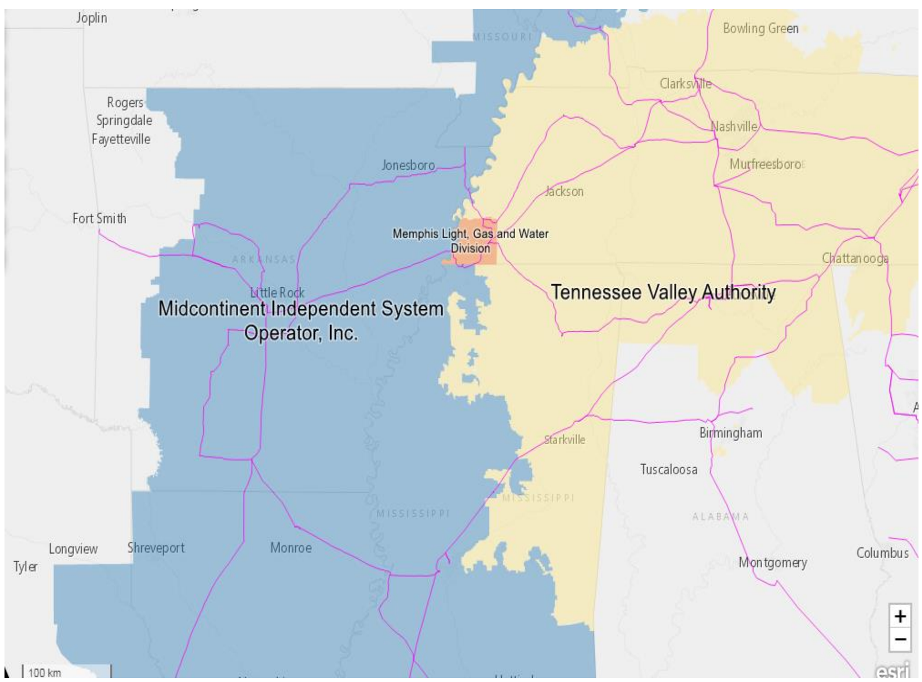


Figure 9. [5]



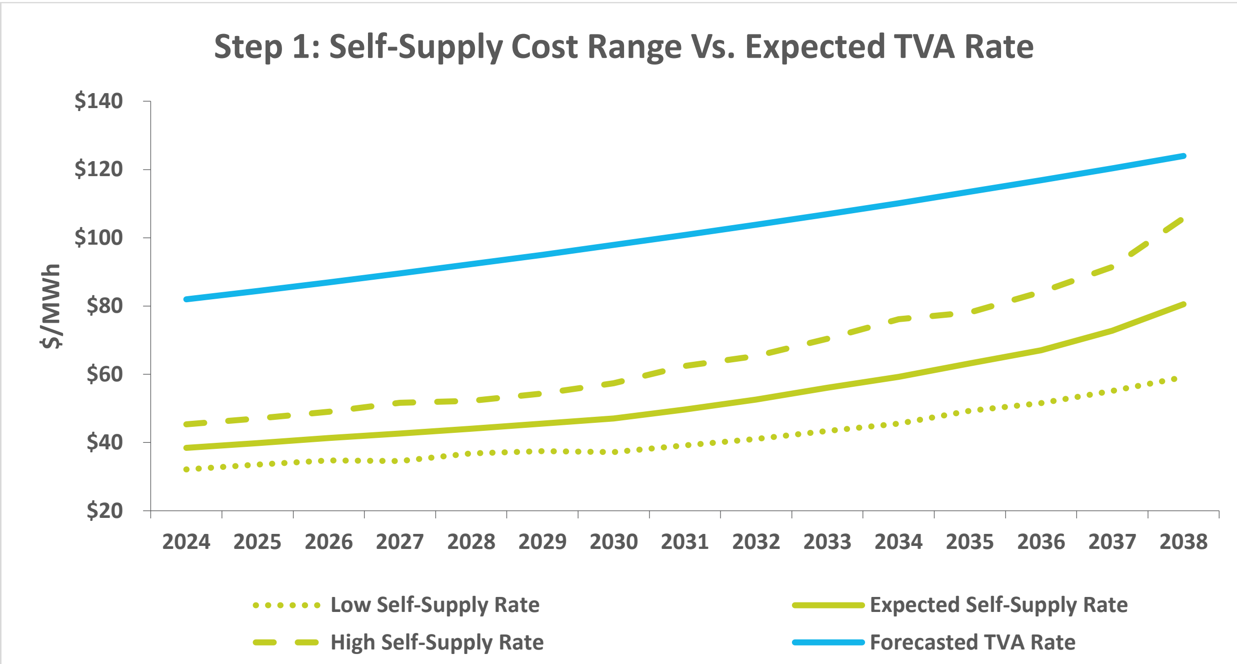
In this analysis, ACES forecasts the wholesale power costs for MLGW in the MISO wholesale marketplace before and after layering in different hedges to build a portfolio. The final power costs includes energy, capacity, ancillary services, and network transmission charges. Over the 15-year time horizon in the analysis, the power costs are expected to range between $38/MWh and $81/MWh if MLGW joins the

[4] SNL Map Builder Tool

[5] SNL Map Builder Tool – including 500kV system

MISO market and does not layer in any power supply assets or hedges. ACES would never recommend a strategy of relying completely on the spot market; however, it illustrates that even with a volatile market, the power costs are still below the current and forecasted TVA rate. Figure 10 below compares the forecasted TVA rate with the range of power costs under 90% of potential market conditions if MLGW were to join MISO and not hedge any of the risk discussed.

Figure 10.



This wholesale market forward price curve is approximately $40/MWh below the forecasted TVA rate. Even the high, risk adjusted power costs are approximately $30/MWh below the low self-supply TVA rate. Despite the savings, without a power supply portfolio, MLGW would have substantial volatility in its power costs, which would not be good for its consumers. This market price risk can be hedged through building an appropriate power supply portfolio using forward market hedges, building resources, or contracting with other market participants. A strategic hedge plan to limit the variability in power costs would provide MLGW with the stability in power costs it is accustomed to with the current TVA contract. The next four steps highlight the costs and benefits of this power supply portfolio development program.

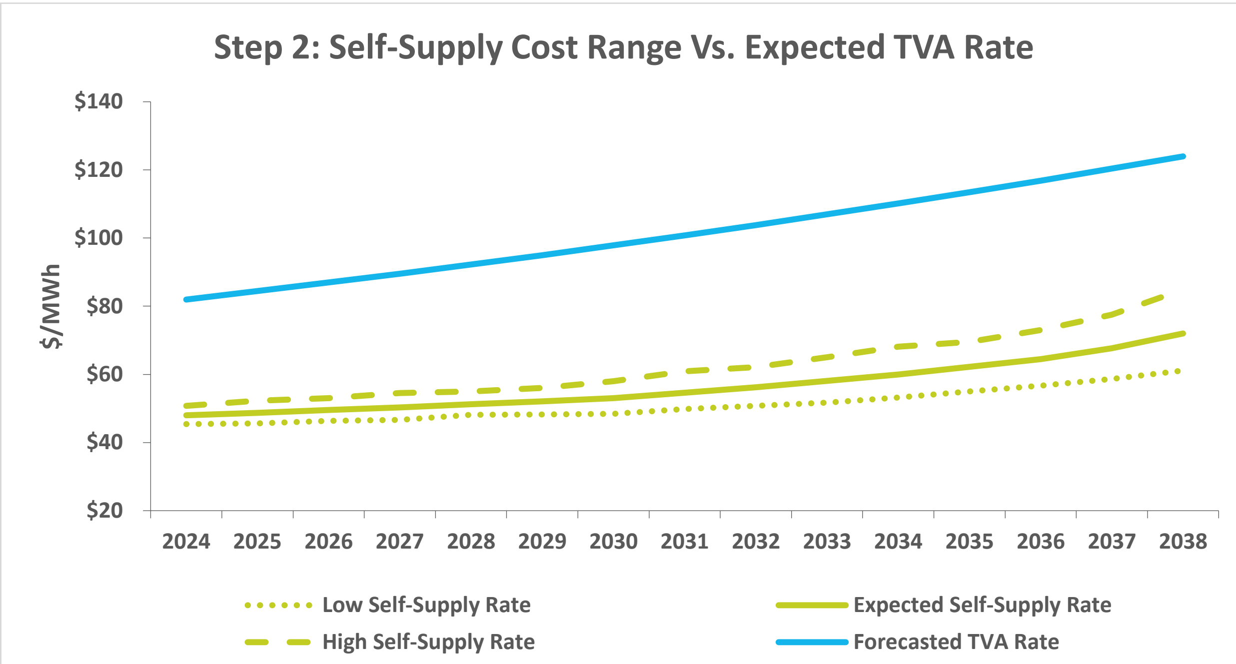
4.2. Step 2 of Building a Portfolio: Baseload Hedge

Figure 11.

How to Build a Self-Supply Portfolio			
Step	Portfolio Need	Sample Portfolio	Portfolio Energy %
Step 1	Market Access	MISO	41%
Step 2	Baseload Supply	1,000 MW Market Purchase	59%
Step 3			
Step 4			
Step 5			

Portfolio Assumption: MLGW purchases a long-term contract for 1,000 MW for all hours of the year at a fixed price of $45/MWh inclusive of energy, capacity, and any delivery necessary to the MISO system. Based on ACES' experience in wholesale markets, this is a reasonable expectation and the likely outcome is achieving a cost lower than assumed herein. Figure 12 compares the forecasted TVA rate with the range of power costs under 90% of potential market conditions if MLGW hedges the baseload portion of the risk by purchasing a 1,000 MW PPA at $45/MWh.

Figure 12.



The impact of the baseload hedge is that the final power costs to MLGW increases in the early years and decreases in the latter years relative to the expectation of the MISO spot market above in Step 1. More importantly, the market price risk is reduced by more than 50% (less gap in price range from Figure 10 on page 11), and the projected risk reduction (reduce exposure to higher prices) of the fixed price hedge is more than $1.5 billion over the 15-year time horizon.

4.3. Step 3 of Building a Portfolio: Intermediate Hedge

Figure 13.

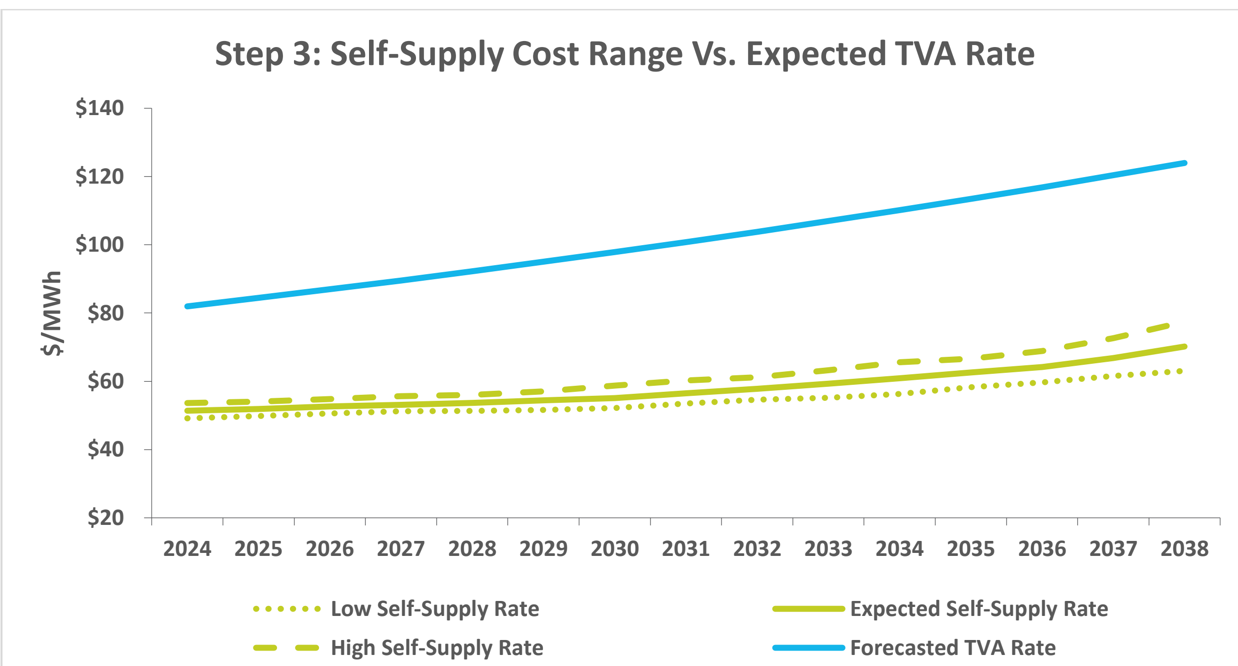
How to Build a Self-Supply Portfolio			
Step	**Portfolio Need**	**Sample Portfolio**	**Portfolio Energy %**
Step 1	Market Access	MISO	24%
Step 2	Baseload Supply	1,000 MW Market Purchase	59%
Step 3	Intermediate Supply	900 MW Combined Cycle	17%
Step 4	Renewable Supply		
Step 5	Peaking Supply		

Step 3 in building a self-supplied portfolio is to hedge the intermediate portion of the power supply portfolio. The intermediate portion of the portfolio represents the demand beyond the baseload hedge that occurs approximately 50% of the time, primarily Monday through Friday when consumers are awake and businesses are open. The value of a natural gas-fired combined cycle generator (combined cycle) is that, on average, it is available during the high demand periods of each seasonal consumer load pattern, and cycles up and down as demand fluctuates. This type of generation can also be turned off during low price hours/periods, which typically correspond to low demand periods.

This hedge can be obtained by building generation, which covers energy and capacity, by entering into a PPA from an intermediate generator for capacity and energy, by purchasing a distressed asset, or it can be served from the market and complemented by financial hedges at the trading hub through block energy (consistent energy for a given set of hours) or call options (energy when market conditions meet certain specifications).

The assumption for purposes of this analysis is that MLGW will build a new combined cycle resource. Based on the estimated MLGW electricity demand, the combined cycle resource is estimated to be 900 MW; however, a combined cycle can vary in size and scale. A new build 900 MW combined cycle can be built at several locations in MISO; however, the location that provides the best hedge against demand costs would be close to the MLGW load. Therefore, ACES utilized Arkansas Hub pricing to determine the estimated revenue for the resource and applied the economics of the resource to total costs. Figure 14 below compares the expected TVA rates with the range of power costs under 90% of potential market conditions if MLGW layers in the intermediate hedge and alleviates this risk.

Figure 14.



While the expected price increases by up to $3/MWh relative to Step 2, the risk to the portfolio decreases by at least $1/MWh in the early years and by up to $6/MWh by 2038. This represents $580 million in risk reduction over the period of the study.

This strategy does require significant fixed costs and debt. For example, building a 900 MW combined cycle will likely require between $800 million and $1.1 billion in capital cost plus ongoing maintenance and operation expenses. These capital and maintenance costs are all considered in this analysis and accounted for over the 30-year useful life of the asset; however, actually obtaining the capital, the implications on MLGW's credit score, and the increased staff required to run the facility are factors MLGW needs to consider and understand before making a decision.

4.3.1. Distressed Asset(s)

To be conservative, the study analyzed the cost of a new build for the majority of the buildout. There is, however, a market for distressed assets. Distressed assets are typically older assets; therefore, the technology is not as efficient as a new asset, but the capital cost is significantly less. The most likely candidates for purchase are natural gas facilities, but there is a market for renewable assets, as well. For example, in 2018, there were 16 natural gas asset transactions in MISO. The prices ranged between 30% and 65% of the cost of a new facility, depending on technology, size, and age of the facility. If MLGW decides to self-supply, it will be beneficial to determine what assets are available and weigh total cost, technology, life of the asset, etc. before making a power supply decision and determining if new assets should be built.

4.4. Step 4 of Building a Portfolio: Renewable Hedges

Figure 15.

How to Build a Self-Supply Portfolio			
Step	**Portfolio Need**	**Sample Portfolio**	**Portfolio Energy %**
Step 1	Market Access	MISO	11%
Step 2	Baseload Supply	1,000 MW Market Purchase	51%
Step 3	Intermediate Supply	900 MW Combined Cycle	13%
Step 4	Renewable Supply	1,000 MW Solar + 500 MW Wind	25%
Step 5	Peaking Supply		

The cost for renewable energy in the MISO footprint has declined dramatically over the past 10 years, which makes solar and wind resources attractive options when ensuring enough resources are available in its portfolio to cover demand. Solar and wind projects also provide a hedge against potential future carbon legislation.

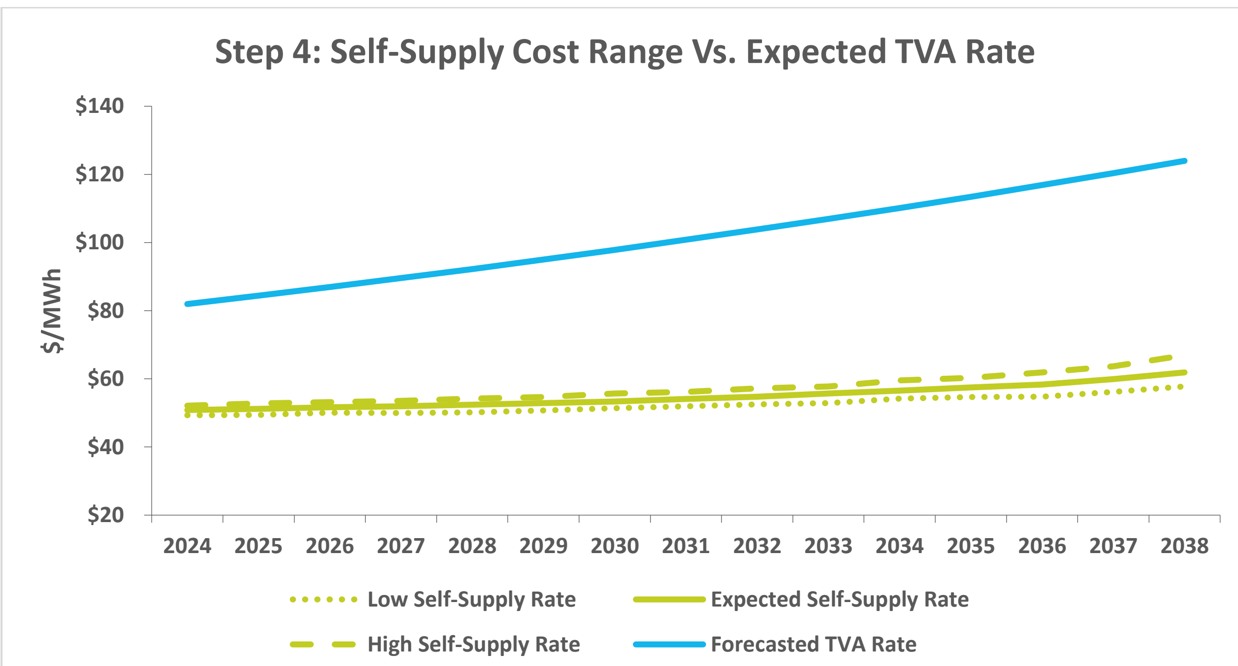
Assumption: 20-year agreements for the purchase of solar generation cost $30/MWh. ACES has recently observed prices slightly lower, but conservatively used $30/MWh.

Assumption: 20-year agreements for the purchase of wind generation cost $21/MWh.

One significant advantage to the MISO market is access to regions with high utilization of wind generation and a growing solar market. For the purpose of this analysis, ACES chose a target of 25% of the energy MLGW procures on an annual basis to be from wind and solar projects. In this analysis, to accomplish the 25% renewable goal, ACES assumed 1,000 MW of nameplate solar generation and 500 MW of nameplate wind generation. MISO has specific rules regarding how much of the total wind and solar are eligible for the capacity market. Currently, 15.7% of total nameplate capacity for wind is eligible and 50% of total nameplate capacity for solar is eligible for the capacity market. All these factors are considered in the analysis and generation revenue projections.

Solar generation has a greater potential to be built in the southern portion of MISO. For consistency, solar generation was modeled at Arkansas Hub. Conversely, the best locations for wind generation are in northern MISO and, therefore, wind was modeled at Minnesota Hub to determine energy and capacity revenues. Typically, renewable resources are built by renewable developers and contracted or sold to the utility. Alternatively, a portion of the requirements can be obtained through local programs such as rooftop or community solar. Figure 16 below compares the forecasted TVA rates with the range of power costs under 90% of potential market conditions if MLGW layers in these forward renewable hedges to alleviate the next layer of price risk.

Figure 16.



The cost of renewable energy continues to decline; therefore, by layering in a 25% renewable portfolio power costs actually decrease over the study period. Similar to the baseload purchase, renewable purchases are made at a flat fixed price over the life of the contract. Power costs decreases by $1/MWh in 2024, and $8/MWh by 2038 relative to Step 3 above. In addition to power cost impacts, the renewables decrease the power cost risk by between $1/MWh and $2/MWh through the study period, which equates to approximately $328 million in risk reduction relative to Step 3 of the process.

4.5. Step 5 of Building a Portfolio: Peaking Hedges

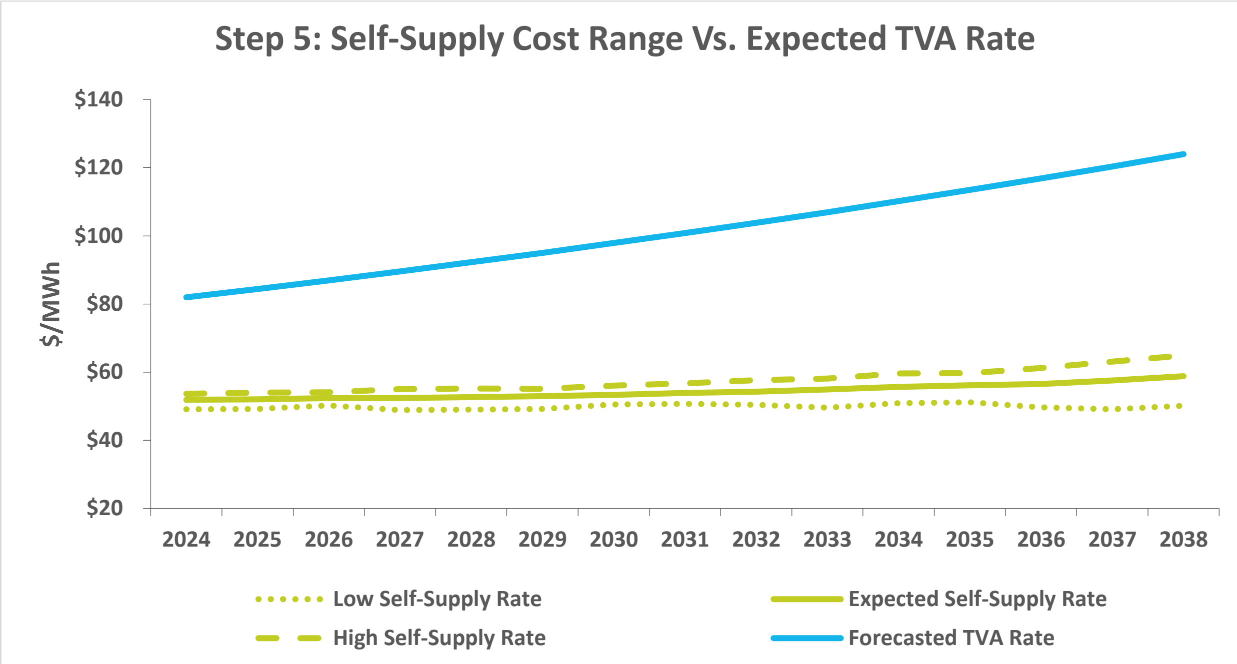
Figure 17.

How to Build a Self-Supply Portfolio			
Step	**Portfolio Need**	**Sample Portfolio**	**Portfolio Energy %**
Step 1	Market Access	MISO	7%
Step 2	Baseload Supply	1,000 MW Market Purchase	51%
Step 3	Intermediate Supply	900 MW Combined Cycle	13%
Step 4	Renewable Supply	1,000 MW Solar + 500 MW Wind	25%
Step 5	Peaking Supply	650 MW Quick Start Peaking	4%

The final step in this process is to determine how to manage the peak or high demand periods in the portfolio, as well as ensuring the portfolio has an appropriate amount of generation capacity. Typically, these resources or contracts are utilized less than 10% of the time, but when they are utilized it is during high demand and typically high price periods or due to local delivery concerns. These peak periods can be hedged by building generation – combustion turbine (CT) generation resources or quick start peaking generation resources – which covers energy and capacity, by entering into PPAs with CT generators for capacity and energy, by purchasing a distressed asset, by procuring battery storage (potentially), or purchased from the market complemented by financial hedges at the trading hub through call options (energy when market conditions meet certain specifications). **The assumption for this analysis is that MLGW will build a set of quick start peaking generation resources for a total of 650 MW.** Similar to the combined cycle resource, the final scope of the quick start peaking generation can vary in size and scale. The major factors in determining the size of the peaking resources is the renewable portfolio make-up, the capacity position, and the projected peak load and load growth in the portfolio. Furthermore, the peaking portion has the greatest potential for disruption if battery storage becomes more economic or more efficient in the future. Based on the renewable portfolio assumptions in Step 4 and the current economics of other resources, 650 MW of quick start peaking generation was assumed to be reasonable.

The location with the best hedge against load costs is going to be close to the MLGW load zone; therefore, Arkansas Hub pricing was assumed to determine the revenue of the resource and apply the economics of the resource to total power costs. Figure 18 on the next page compares the forecasted TVA rate with the range of power costs under 90% of potential market conditions if MLGW layers in these peaking hedges and alleviates the next layer of risk.

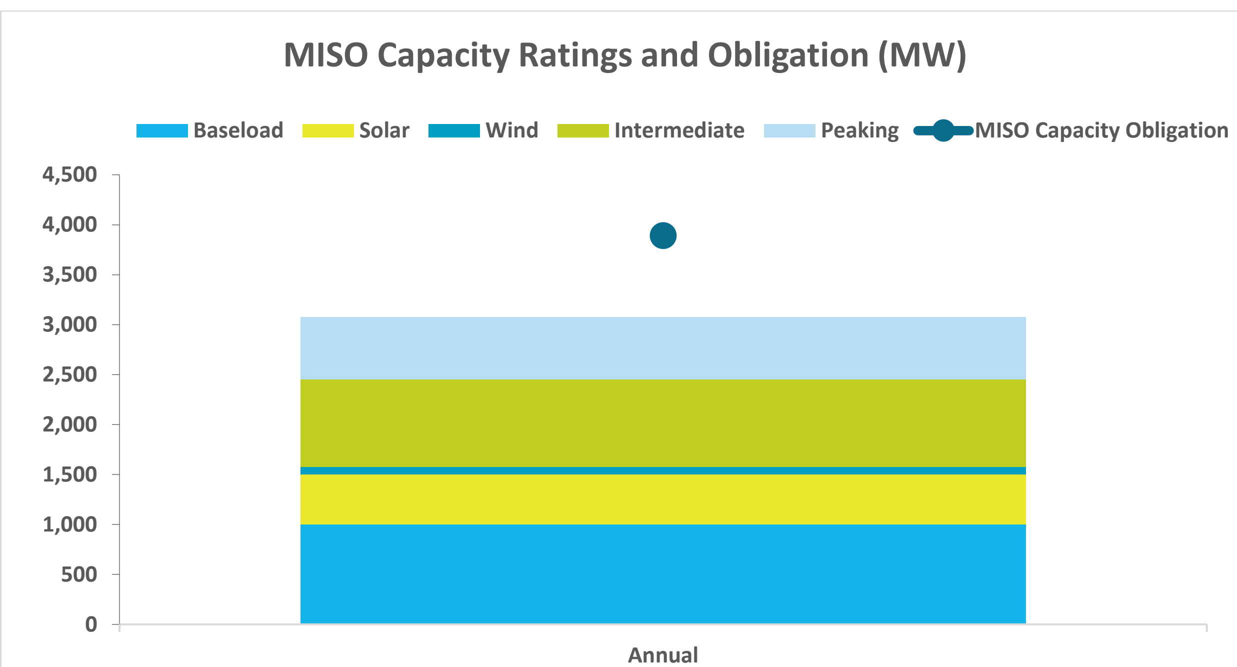
Figure 18.



The power cost in Step 5 is within $1/MWh of the cost in Step 4 of the process; however, the risk to the portfolio increases by approximately $1/MWh throughout the study period. The increase in risk is due to the volatility in the natural gas market and the limited use of these peaking resources. The value in the peaking resources lies in the capacity market and limiting the exposure to capacity clearing price.

4.6. Request for Proposals

Figure 19.

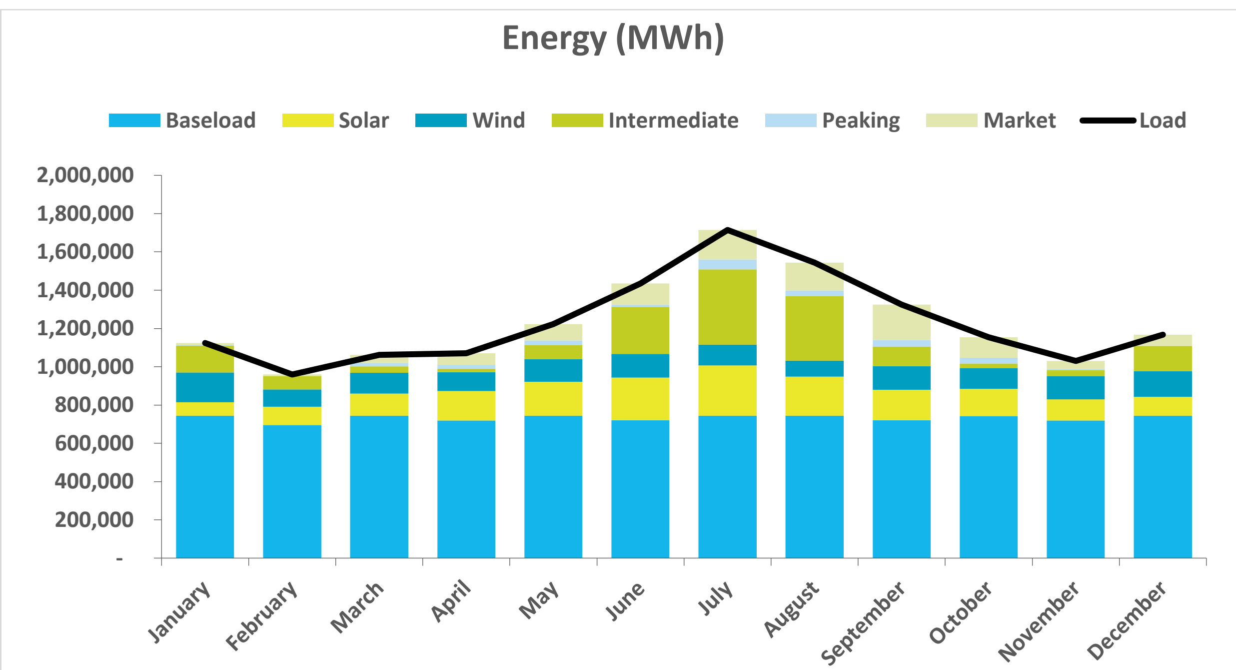


The portfolio outlined in this process layers in a substantial baseload hedge, has a 25% renewable portfolio standard, layers in a reasonable amount of intermediate and peaking resources, and leaves limited market exposure for MISO's capacity and energy market. Figure 19 summarizes the approximate position MLGW can expect in MISOs capacity market; however, the renewable resources will likely receive higher quantities once they are in-service and their output can be verified by MISO.

For each step after Step 1 highlighted throughout this process, ACES recommends that MLGW conduct a formal RFP. An RFP is a solicitation to generation developers, owners, power marketers and financial institutions to provide pricing for a specific product. For example, for Step 2 of the process, MLGW could issue an RFP for 1,000 MW of baseload energy and capacity for a minimum of 15 years starting in 2024, with a preference for delivery in MISO South, Arkansas Hub, or the MLGW load zone. Developers or asset owners will provide MLGW proposals to serve this portion of the portfolio. The proposals will help MLGW determine the best fit for its portfolio given location, size, cost, etc. and validate pricing assumptions. Given the baseload portion covers more than 50% of the portfolio costs, this should be an early step in the process, as securing this portion essentially guarantees savings on the entire portfolio compared to the TVA rate for the 15-year period of this study.

If the sample portfolio is utilized and once the appropriate hedges are layered in, the position shows a substantial portion of the portfolio is covered through the baseload hedge. The intermediate hedge provides the greatest value to the demand during the highest load periods. The renewable output varies by season with higher solar in the summer and higher wind in the spring and fall. Figure 20 below displays the average position by month for each resource to serve expected load.

Figure 20.



5. Ongoing Portfolio Management

The steps provided in Section 4 of this report represent only some of the ways in which MLGW's portfolio can be set up in the wholesale marketplace. The key factors that MLGW has to consider are ranking the importance of total cost, risk tolerance (how exposed to market prices and market volatility), renewable targets, and willingness to take on the fixed costs associated with long-term contracts or generation build. While no system is perfect, one of the benefits of joining a RTO is the flexibility it provides to control your own portfolio with regard to fuel mix and risk preferences, while maintaining reliability and managing stable power costs.

5.1. Energy Risk Management Policies

Throughout this analysis, there is discussion regarding forward hedging capacity and energy to fix MLGW's power costs. It is recommended that MLGW develop policies to establish targets and manage the portfolio hedging needs. Another variable to consider is hedging the fuel of owned assets and exposure through contracts. For example, the sample portfolio includes a natural gas combined cycle resource that is expected to produce energy a significant portion of the time. Natural gas prices are volatile; therefore, the risk of the unit becoming uneconomic and not running during certain periods is greater if there are no fuel hedges in place. If the unit is uneconomic and not running, it is not providing the energy hedge it is intended to provide. When developing an energy risk management policy for the power supply portfolio, ACES recommends including a process for hedging the fuel sources.

5.2. Other Risks/Costs

There are also risks to the forecast that cannot be addressed through fundamental modeling. First, the MISO capacity market is dependent on the supply of the entire market, as well as the transmission expansion. If the MISO market were to over-build, there is a case to be made that MLGW could take advantage of the low market prices and build less of its own generation. Conversely, if the MISO market retires resources without associated new build, MLGW could choose to build additional assets to protect against higher capacity prices.

The second consideration is other MISO fees. MISO transmission expansion and administrative fees are currently low (~$2/MWh) and the goal is to maintain this low level; therefore, the assumptions in this analysis are mostly negligible.

Similar to MISO administrative fees, it is also likely that MLGW will need energy management and market interaction services. This is also a negligible fee relative to power costs and likely can be accomplished for less than $1/MWh relative to total power costs. A service provider can perform these services, which include hourly trading, market settlements, long-term risk management services, regulatory compliance, among other services.

6. Next Steps

Given the results of this analysis, there are several logical next steps MLGW can consider. Essentially, the goal is for MLGW to explore available options over the next several months in order to make an informed decision regarding whether to stay with TVA or notice out of the agreement. To assist in this process, before a utility joins MISO, MISO will complete an assessment of the impact of joining the market. The assessment will provide details regarding transmission necessary (if any) to integrate MGLW's system into MISO, including the projected cost, administrative fees, transmission needs and costs, and a cost/benefit analysis.

MLGW also needs to conduct a legal review to understand the implications of exiting its agreement with TVA and leaving the TVA balancing authority to join MISO. There are provisions regarding "cherry picking" in most deals of this nature, and MLGW needs to understand its rights regarding leaving TVA and joining another balancing authority. ACES did not complete a legal review in this regard, and gives no assurances as to the viability of this course of action without further considerations or financial impacts.

While MISO is completing its analysis, MLGW should conduct an RFP to determine the availability and cost of baseload supply to confirm it is comparable to this high level assessment. However, with $9.2 billion in expected savings, there would have to be catastrophic changes for the RFPs to provide significantly different outcomes compared to the estimates provided herein.

In addition to the cost/benefit analyses, it is important to understand what MISO does to provide reliability, the skills MLGW needs to acquire or outsource, and how MLGW's business would change by joining MISO. This is typically accomplished through a series of training courses from MISO, an energy services provider, or an energy consultant.

7. Conclusion

The purpose of the analysis is to determine if MLGW should consider self-supplying its electricity needs or stay with its all-requirements deal with TVA. ACES outlined a reasonable scenario for MLGW to join the MISO market, layer in appropriate hedges through purchases and resource buildout while managing a "green" portfolio, limiting the risk in the portfolio, and managing reliance on the MISO market beyond the reliability function. Throughout this analysis, the estimated net savings over the 15 year period analyzed exceeds $9.2 billion. The annual cost reductions range from $413 million in 2024 to $817 million in 2038. Figure 21 on the next page shows the expected self-supply power costs compared to the forecasted future TVA rate based on an estimated 1% increase, 2.1% increase and a 5% increase on an annual basis, while Figure 22 shows the total expected savings over the 15-year study period.

Figure 21.

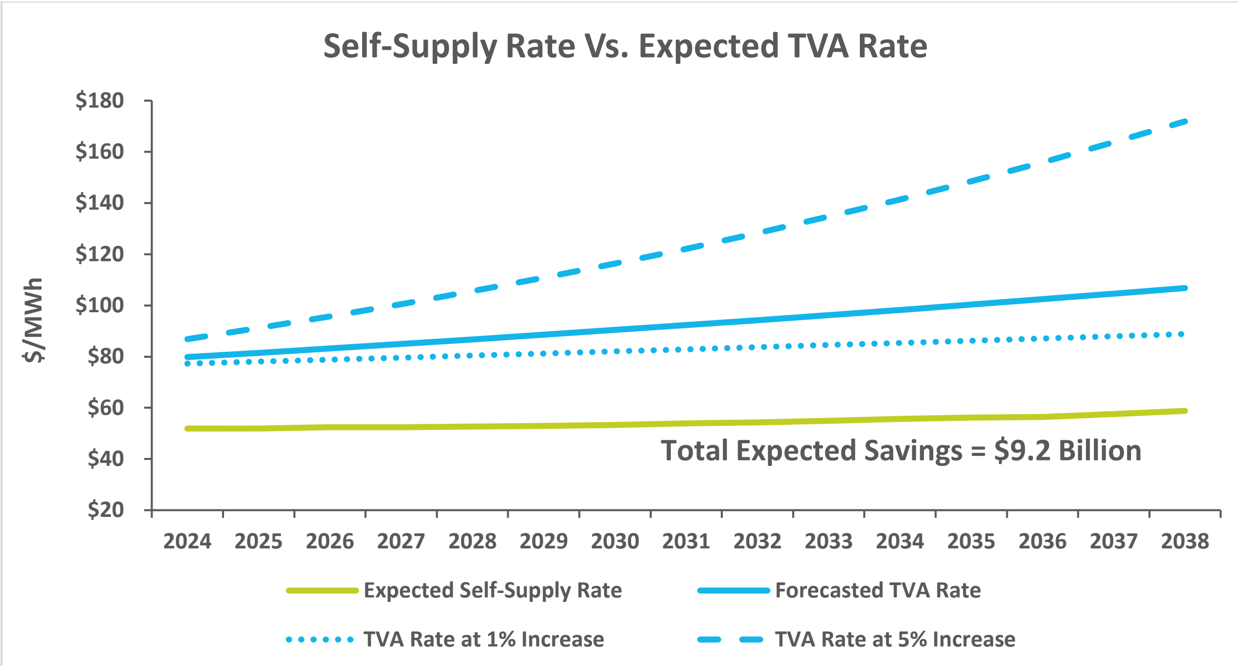


Figure 22.

Total Expected Savings From Self-Supply vs. Paying TVA Rates		
1% TVA Rate Increase	**2.1% TVA Rate Increase**	**5% TVA Rate Increase**
$6.8 Billion	S9.2 Billion	$17 Billion

This report provides high level insight into the power cost savings MLGW could achieve by exiting their existing TVA contract. There are a lot of details and assumptions that go into a self-supply analysis. If MLGW is interested in exploring the possibilities for savings outlined in this report, ACES is available to provide additional information and assistance.