Public Service Commission of Wisconsin
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BEFORE THE
PUBLIC SERVICE COMMISSION OF WISCONSIN

Application of Madison Gas and Electric Company for a Certificate of Authority for Construction, Installation, and Placement in Operation of a Wind Electric Generation Facility Known as Saratoga Wind Farm in Howard County, Iowa.	Docket 3270-CE-127

Direct Testimony of Ariel Horowitz, PhD
On Behalf of Sierra Club

[redacted]

September 15, 2017

1. INTRODUCTION AND PURPOSE OF TESTIMONY

Q Please state your name, business address, position, and upon whose behalf you are testifying in this case.

A My name is Ariel Horowitz. I am a Senior Associate with Synapse Energy Economics, Inc. ("Synapse"), which is located at 485 Massachusetts Avenue, Suite 2, in Cambridge, Massachusetts. I am testifying on behalf of Sierra Club.

Q Please describe Synapse Energy Economics.

A Synapse Energy Economics is a research and consulting firm specializing in electricity and gas industry regulation, planning, and analysis. Our work covers a range of issues, including economic and technical assessments of demand-side and supply-side energy resources; energy efficiency policies and programs; integrated resource planning; electricity market modeling and assessment; renewable resource technologies and policies; and climate change strategies. Synapse works for a wide range of clients, including state attorneys general, offices of consumer advocates, trade associations, public utility commissions, environmental advocates, the U.S. Environmental Protection

Agency (EPA), U.S. Department of Energy (DOE), U.S. Department of Justice, the Federal Trade Commission, and the National Association of Regulatory Utility Commissioners. Synapse has over 25 professional staff with extensive experience in the electricity industry.

Q Please summarize your professional and educational experience.

A At Synapse, I have worked extensively on issues related to energy system planning, data analysis, and the use of new technologies. My work has included comments on integrated resource plans, as well as reports on and modeling of policy-driven changes to the energy sector pertaining to Oregon, Michigan, Puerto Rico, Connecticut, and the Regional Greenhouse Gas Initiative member state region. I have provided consulting services for clients including the Energy Commission of Puerto Rico, U.S. EPA, the District of Columbia Office of the People's Counsel, the Michigan Public Service Commission and Department of Environmental Quality, multiple renewable energy developers, and the Sierra Club.

I have provided expert analysis and testimony on issues related to utility planning, revenue requirement, forecasting, and operations on behalf of the Energy Commission of Puerto Rico. I have also testified on grid modernization issues before the Massachusetts Department of Public Utilities.

I hold a Doctorate in Chemical Engineering from Tufts University as well as a BS in Engineering from Swarthmore College. My research focused on design and use of electrochemical energy storage technologies. My resume, attached as Exhibit Ex-SC-Horowitz-1, presents additional details of my professional and educational experience.

Q On whose behalf are you testifying in this case?

A I am testifying on behalf of the Sierra Club.

Q What is the purpose of your testimony in this proceeding?

A My testimony reviews the application of Madison Gas & Electric Company ("MGE" or "Company") for a Certificate of Authority to construct and operate a 66 MW wind generation facility at the Saratoga Wind Farm site in Howard County, Iowa ("Saratoga

Project"). I assess the economic analysis performed by MGE and evaluate the value proposition posed by the acquisition of new wind resources. I also comment on whether investment in new wind generation in the near term is in the interest of MGE's ratepayers and consistent with the policy goals of the state of Wisconsin and the Wisconsin Public Service Commission ("PSCW" or "the Commission").

Q Please summarize your findings and recommendations.

A After reviewing the evidence provided by MGE in this case, I conclude that: (1) the Commission should grant a Certificate of Authority for the Saratoga Project and (2) the Commission should require MGE to proactively seek other opportunities to acquire low-cost, high-performance wind resources in the near term.

My review shows that the Saratoga Project and additional near-term wind investments are cost-effective under the most likely future scenarios. Because high capacity factor wind resources will most likely displace market energy purchases, they would not provide facilities unreasonably in excess of the Company's future requirements. Instead, additions of at least [redacted] MW of new high capacity factor, low-cost wind generation will protect MGE's ratepayers from market and fuel price increases and will provide benefits based on energy value alone. As such, completion of the proposed project and additional near-term procurement of low-cost, high-performance wind resources will reduce the Company's cost of service, and therefore customer rates, in the most likely future scenarios.

In light of these findings, I recommend:

- That the Commission approve MGE's application for a Certificate of Authority in this case.
- That the Commission direct the Company to seek additional near-term wind acquisition opportunities for additional high capacity factor wind resources in various block sizes, up to a cumulative capacity of at least [redacted] MW.
- That the Commission require MGE to regularly evaluate the wind resources available to it, as the marketplace for new wind generation is developing rapidly and facility costs and performance will continue to shift in the near term.

- That the Commission order MGE to report back to the Commission and parties regularly, but no less frequently than every six months, on its progress toward additional wind acquisition and evaluation of the market costs and performance of new wind.

2. APPLICATION AND CONTEXT

Q What does the Company seek in this docket?

A The Company seeks a Certificate of Authority to purchase a wind generation facility currently under development in Howard County, Iowa. This facility is named the Saratoga Wind Farm and is proposed to have a nameplate capacity of 66 MW.

Q On what grounds does the Company seek such a certificate?

A The Company justifies its application by arguing that the Saratoga project will provide benefits to customers in the form of lower overall system costs. MGE does not suggest that the Saratoga Project will solve any pressing near-term shortfalls for capacity or energy, nor does it have a near-term need for additional resources to meet Renewable Portfolio Standard (RPS) compliance obligations. Instead, the Company's application states that "[t]otal costs to all customers will be lower over time…with the Saratoga Project than without it."[1] The Company further argues that it must make an investment in new wind power now, for two primary reasons: first, the federal Production Tax Credit (PTC) provides a substantial portion of the project's cost-effectiveness but will soon expire;[2] and, second, MGE faces competition from other nearby utilities for prime-quality wind development sites.[3] I discuss both of these points further below.

Q How did the Company support its application?

A The Company provided direct testimony and an economic analysis in support of its application. The Company's economic analysis of the project is based on modeling it

[1] Ex.-MGE-Application at p. 1 (sponsored by Bollom, see Direct-MGE-Bollom-2).
[2] Direct-MGE-Bollom-4.
[3] MGE Response to SC-INT&RFP-3-8a, attached as Ex-SC-Horowitz-2.

conducted using the Electric Generation Expansion Analysis System ("EGEAS") model.[4] EGEAS modeling results are the primary evidence provided by the Company demonstrating the cost-effectiveness of the proposed project.

Q Please describe EGEAS.

A EGEAS is a capacity expansion model published by the Electric Power Research Institute. EGEAS is commonly used by utilities in the Midwest and by the Midcontinent Independent System Operator (MISO). Like other utility-grade capacity expansion models, EGEAS can be used to determine the optimal combination of resources over a multi-year future period, given a set of resource options, system constraints, and assumptions regarding resource costs and operational parameters. In this context, the optimal resource expansion portfolio is that which results in the lowest cost to MGE customers.[5] Because EGEAS seeks to find the resource plan that minimizes system costs, the model's selection of any given project as part of an optimal resource portfolio expansion can provide a clear, objective indicator of that project's value to MGE ratepayers—dependent, of course, on input assumptions and options made available to the model.

Q Please describe the scenarios that the Company ran in EGEAS as part of this proceeding.

A MGE initially employed EGEAS to determine a least-cost resource portfolio under three futures: a reference future, a carbon-constrained future, and a future characterized by high gas and energy prices.[6] Under each of these futures, MGE found that the Saratoga facility is part of its least-cost resource plan.[7] MGE also evaluated a number of sensitivity cases. These sensitivities included cases in which MGE assumed that Iowa wind either had a

[4] Ex.-MGE-Application at p. 8.
[5] MGE allowed EGEAS to select unit additions but not to optimize unit retirements. MGE supplied the unit retirement assumptions. Therefore, the model optimized resources based on those assumptions, which is not necessarily the optimum plan if unit retirements are allowed to change from MGE's assumptions.
[6] Ex.-MGE-Application at pp. 8-10.
[7] Ex.-MGE-Application at pp. 30-31.

lower capacity factor or faced a lower PTC than expected.[8] Under both of these sensitivities, Saratoga continued to be part of MGE's least-cost portfolio. Notably, the EGEAS model also chose to add an additional [redacted] MW blocks of generic Iowa wind capacity in addition to the Saratoga Project (a total of [redacted] MW of new wind).[9]

In response to a request by Commission Staff, MGE performed additional sensitivity analyses, among which were sensitivities evaluating the impacts of lower gas prices, lower and higher demand and energy forecasts, and two additional lower capacity factor assumptions for Iowa wind. MGE found that the Saratoga facility was part of its optimal plan under each of these sensitivities.[10] An additional [redacted] MW of wind capacity is part of the optimal plan in most of these additional cases. EGEAS adds an additional [redacted] MW of generic Iowa-sited wind in every scenario in which that resource was modeled with a capacity factor of at least 45% and added [redacted] MW with a capacity factor of 40%.

The relevant subset of the scenarios tested, and the total wind capacity added in 2019 and 2020 in each scenario, are summarized in Table 1 below.

[8] MGE also ran sensitivity cases that were meant to test specific "no-build" alternatives or examine the favorability of specific resources under reference case assumptions regarding fuel prices, load, and other key input factors.
[9] Ex.-MGE-Application at p. 11.
[10] Direct-MGE-Block-7.

Table 1. Wind additions in selected model runs. [11]

	Scenario description	Scenario name	Saratoga Project	IA wind added in 2020 (MW)	Filed as part of…
Base Planning Scenarios	Future 1 - Reference Case	MGEp1f1a	Chosen	[redacted]	Appendix E
	Future 2 - Carbon Constraint	MGEp1f2a	Chosen	[redacted]	Appendix E
	Future 3 - Carbon Constraint and High Gas Prices	MGEp1f3a	Chosen	[redacted]	Appendix E
PTC	80% PTC	MGEp1f1i	Chosen	[redacted]	Appendix E
Capacity Factor	45% CF	MGEp1f1j	Chosen	[redacted]	Appendix E
	40% CF	MGEp1f1m	Chosen	[redacted]	PSCW 1.07
	35% CF	MGEp1f1n	Chosen	[redacted]	PSCW 1.07
Gas Prices	Lower gas prices	MGEp1f1s	Chosen	[redacted]	PSCW 1.05
Demand	Lower demand	MGEp1f1t	Chosen	[redacted]	PSCW 1.05
	Higher demand	MGEp1f1u	Chosen	[redacted]	PSCW 1.05

Q Do these scenarios represent a reasonable range of possible futures?

A Yes. While I do not necessarily endorse every assumption used by MGE, the combination of the scenarios originally tested by the Company and those added in response to PSCW requests cover a reasonable range of likely future values for the most important inputs to this analysis for purposes of this case—including fuel and market prices, demand conditions, and the performance of new wind resources.

Q What is the Company's interpretation of the results of its EGEAS runs?

A MGE interprets its modeling results as demonstrating that "pursuit of the Saratoga Project is consistent with a 'no regrets' approach that provides economic benefits to its customers"[12] and that total costs to all customers will be lower over time across a range of futures with the Saratoga Project included in MGE's energy mix than without it."[13]

[11] Ex-SC-Horowitz-3
[12] Direct-MGE-Bollom-5.
[13] Direct-MGE-Bollom-4.

Q Do you agree with this interpretation?

A Yes, although I would extend this interpretation to also cover additional near-term wind acquisitions, which are also included in the majority of the scenarios modeled by the Company. I interpret the Company's modeling results as demonstrating that at least [redacted] MW of new wind resources are part of its least-cost plan over a wide range of gas prices, market prices, and demand conditions. These results indicate that the Company's choice to invest in wind now is well-supported and robust and that the 66 MW Saratoga Project undershoots the amount of wind that MGE should procure before the PTC expires.

3. NEAR-TERM WIND IS A LOW-RISK, HIGH-RETURN INVESTMENT

Q Why do the Saratoga Project and additional investments in wind in the near term represent a low-risk investment for ratepayers?

A Quite simply, near-term investments in wind are among the cheapest sources of energy for utilities in the Midwest. The confluence of cost declines and technology improvements, access to excellent wind resource, and the federal PTC has led to the creation of a class of extremely low-cost wind projects in the Midwest. This class of facilities can offer customers many benefits, low cost being foremost among them.

Q Is the Saratoga Project a member of this class?

A According to my review of MGE's application, yes. The Saratoga Project comes at a comparable cost to other successful wind projects,[14] although recent data from other nearby utilities suggests that even lower-cost projects may be available.[15] The Saratoga Project is also located in a region with historically well-performing wind resources.[16]

Q Are other such opportunities likely available to the Company?

A Yes. There is a significant amount of wind power currently under development in Iowa as well as other neighboring states, and an additional 14.5 GW of wind power is expected

[14] MGE Response to SC-INT-1, attached as Ex-SC-Horowitz-4.
[15] See, for example, Alliant's recent assumption of a $28.44/MWh LCOE for new wind energy, excerpted in Ex-SC-Horowitz-5.
[16] Attachment to MGE First Supplemental Response to PSCW 01.01, attached as Ex-SC-Horowitz-6.

to be installed in the Upper Midwest region in 2019–2020 based on the MISO interconnection queue. Indeed, the Company indicated an ability to purchase the 78 MW "Independence" project, the 80 MW "Parnell" project, and the as-yet-unsized "Washburn" project from the same vendor as the Saratoga Project.[17] There may be additional projects available to the Company from different vendors as well.

However, the Company may face competition from neighboring utilities in pursuing these opportunities. As the Company's application describes, it sought to purchase other, larger projects offered by the same vendor as the Saratoga Project but MidAmerican Energy out-competed MGE. Because MGE is a smaller company than MidAmerican and other neighboring utilities, it must act with extra vigilance to monitor the additional wind resource opportunities available to it and to take advantage of those opportunities when appropriate. The Commission should require MGE to seek additional wind and reduce any regulatory uncertainty that may otherwise inhibit MGE's quick acquisition of additional wind resources.

Q How do the costs of wind resources compare to other sources of energy available to the Company?

A The Saratoga Project, and other near-term investments in wind, are likely to be among the lowest-cost sources of energy available to the Company on a going-forward basis. On a levelized-cost-of-energy (LCOE) basis, Iowa-sited wind is comparable in cost to energy generated at the Columbia plant and notably less costly than generation from either the Riverside Energy Center Expansion (RECE) or the MISO market (Figure 1).

[17] MGE Response to SC-INT&RFP-3-8, attached as Ex-SC-Horowitz-2, and Attachment to MGE First Supplemental Response to PSCW 01.01, attached as Ex-SC-Horowitz-6.

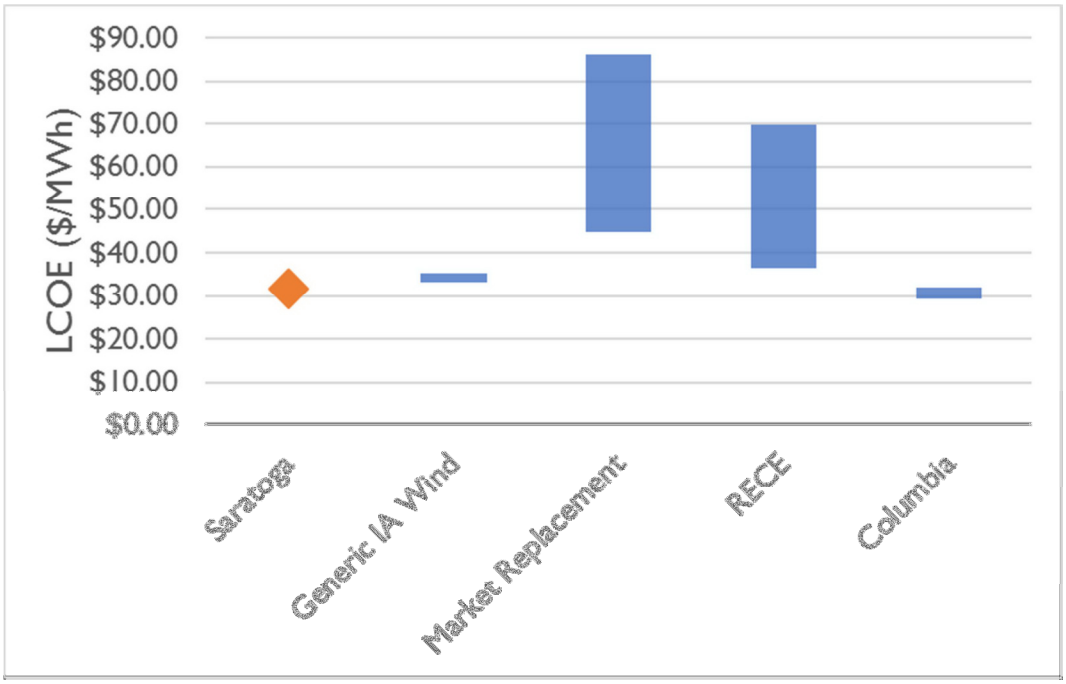

Figure 1. Comparison of levelized costs of energy (LCOE) for various resources available to the Company

Q Please describe the sources for the wind LCOE values shown in this figure.

A MGE provided the LCOE of the Saratoga Project.[18] I used MGE's [redacted] to calculate the LCOE of generic Iowa wind.[19] The range shown in Figure 1 for the Generic Iowa Wind LCOE represents differing treatments of costs incurred in 2018 and 2019 (before the projects' modeled online date). My calculation of the LCOE of Generic Iowa Wind, and of the LCOEs of the other resources shown, can be found in Exhibit Ex-SC-Horowitz-9.

Q How did you calculate the LCOE of the fossil resources as shown in this figure?

A I calculated the range of LCOE for energy from RECE by taking the quotient of the net present value of the resource's generation and net present value of total variable cost (fuel and variable O&M). The minimum of the range represents RECE's LCOE in [redacted]

[18] Attachment to MGE's Response to SC-INT&RFP-2-9, included as part of Ex-SC-Horowitz-7.
[19] .OUT file for scenario MGEp1f1a, included in Ex.-MGE-Application-Confidential Appendix E and excerpted in Ex-SC-Horowitz-7.

[redacted][20] while the maximum represents RECE's LCOE in MGE's [redacted][21] (a scenario [redacted] prices than the reference case).

I used the same methodology to calculate the LCOE of the Columbia plant. There, the low end of the range represents the cost of energy from the Columbia plant in MGE's Future 1, which uses MGE's assumption that coal prices will [redacted][22] [redacted] While I make no particular judgment as to the validity of this assumption, I do observe that coal prices, like gas prices, are subject to uncertainty. To represent the risks associated with potential uncertainty in this value, I also prepared a LCOE value for Columbia assuming that prices rise at a slightly higher rate. I used a growth rate of approximately 3.4 percent, which is the nominal 2017–2041 compound annual growth rate for mine-mouth prices of Powder River Basin coal as published in the Energy Information Administration's 2017 Annual Energy Outlook.[23]

Q How did you calculate the LCOE for market energy in this figure?

A I calculated the LCOE of market replacement energy by using the expected hourly generation of the Saratoga Project[24] to determine the MWh generated in each month during on-peak and off-peak hours. Then, I used MGE's [redacted][25] to calculate the cost of purchasing those MWh from the market rather than obtaining them from the Saratoga Project. Finally, I divided the net present value of the total energy by the net present value of the total costs to arrive at the average levelized price of those market purchases.

The bottom of the range shown for Market Replacement energy represents the cost of market purchases in the Future [redacted] Scenario [redacted] case,[26] while the maximum end of

[20] .OUT file for scenario MGEp1f1s, included in MGE Response to PSCW 1.05 and excerpted in Ex-SC-Horowitz-7.
[21] OUT file for scenario MGEp1f3a, included in Ex.-MGE-Application-Confidential Appendix E and excerpted in Ex-SC-Horowitz-7.
[22] Ex.-MGE-Application-Confidential Appendix E at p. 21.
[23] Data included in Ex-SC-Horowitz-7.
[24] Based on the hourly capacity factor file "IA50CF13.dat", provided as part of [24] Ex.-MGE-Application-Confidential Appendix E.
[25] Ex.-MGE-Application-Confidential Appendix E, Figure 9.20.
[26] *Id.*

the range shows the cost using Future [redacted] assumptions.[27] The cost of market energy in the low gas sensitivity run by MGE [redacted] from that in the reference case.[28]

Q When is it appropriate to compare different resources on a levelized cost-of-energy basis?

A The LCOE is a useful metric to use when comparing the energy costs of different resources over a set time period when the costs of those resources may change over time relative to one another (for example, as gas prices change). LCOE is also a commonly used metric to evaluate the effective cost of generation from renewable generation technologies, which tend to be capital intensive but have little to no variable cost of generation.

Q Does this calculation include capacity-related costs and benefits?

A No. My calculation of LCOE does not include fixed operations-and-maintenance or ongoing capital costs at either Columbia or RECE, nor does it include credit for any resource based on capacity value. Importantly, the comparison is, therefore, a conservative one, with a bias against the value of wind, because it excludes capacity-related costs *and* benefits for the fossil-fired resources but includes the "all-in" cost of the wind resources without crediting them for their capacity value.

Importantly, I did not choose to exclude capacity considerations from my comparison of resource costs because the capacity value of wind is uncertain or risky. To the contrary, wind makes important contributions to the resource adequacy of the region[29] and can, therefore, provide MGE with a capacity value dependent on future capacity prices. The effective load carrying capability (ELCC) value of wind resources is determined by MISO[30] rather than through MGE's own discretion. I chose to exclude these

[27] *Id.*
[28] .OUT file for scenario MGEp1f1s, included in MGE Response to PSCW 1.05 and excerpted in Ex-SC-Horowitz-7.
[29] Wind facilities comprised 2.1 percent of MISO's unforced capacity in 2016. Potomac Economics. "2016 State of the Market Report for the MISO Electricity Markets". June 2017. Fig. 6. Attached as Ex-SC-Horowitz-8.
[30] Ex-MGE-Application-Confidential Appendix E at p. 14.

considerations from my comparison here merely to highlight the fact that wind power is a worthwhile investment even if considered solely for the value of its energy.

Q Please summarize the results of this analysis.

A In sum, a comparison on the basis of LCOE alone demonstrates that wind energy is among the least-cost sources of energy available to MGE on a going-forward basis. On a MWh-for-MWh basis alone, investment in wind is likely to result in lower energy costs for MGE's customers than purchases on the market or investment in additional fossil-fired generation.

4. WIND WILL LIKELY OUTCOMPETE THE MARKET AND REDUCE MGE'S MARKET EXPOSURE RISK

Q Has the Company historically made substantial market purchases on behalf of ratepayers?

A Yes; according to MGE's own website, approximately 30 percent of the energy it supplies to customers comes from market purchase and purchased power agreements.[31] MGE buys approximately [redacted] of its purchased energy on the spot market, based on MGE's EGEAS modeling in this case.[32]

Q How would the purchase of the Saratoga Project plus additional wind projects change the Company's exposure to the market?

A The addition of the Saratoga Project and further new wind projects would primarily displace [redacted] as shown in Figure 2. By adding [redacted] MW of new wind resources, MGE's reliance on the market [redacted] its generation needs by the early 2020s. To the extent that wind generation displaces MGE-owned fossil resources in the near term, such displacement primarily occurs at the West Campus Cogeneration facility.[33] Because MGE and the University of Wisconsin may operate this facility for the purpose of generating steam rather than through

[31] "MGE's 2015 electricity sources", attached as Ex-SC-Horowitz-9.
[32] Ex-SC-Horowitz-10.
[33] Ex-SC-Horowitz-10.

economic electric system dispatch,[34] EGAES results may not be representative of reasonably expected future usage patterns of this plant.

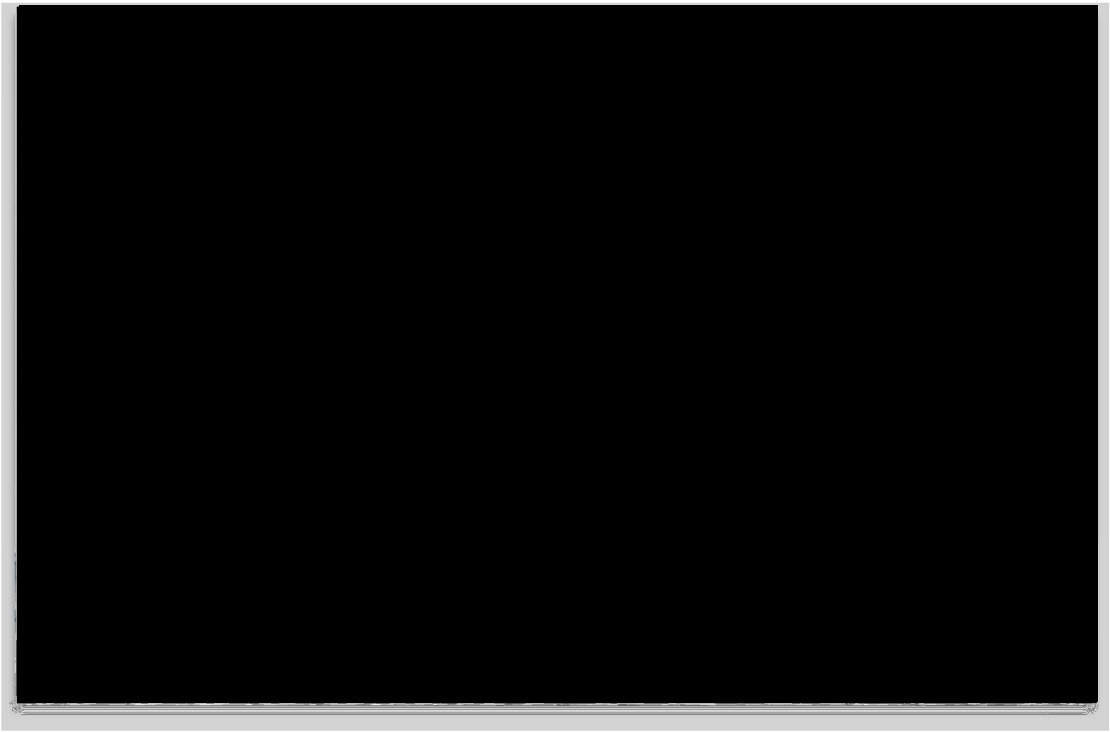

Figure 2. MGE's generation fuel mix over time as modeled in Future 1, Scenario 1[35]

The results in Figure 2 are, of course, dependent on MGE's going-in assumptions regarding the costs of different resources and retirements. In a scenario in which market energy is cheaper than the generation from MGE's own fossil resources, EGEAS would project MGE relying on the market rather than its own coal and gas. However, given MGE's forecasts of market and fuel prices, EGEAS predicts that wind generation will greatly reduce MGE's exposure to the spot market.

Q Why might wind generation be preferable to market energy?

A Wind generation is projected to be preferable to market energy on a simple cost basis. As I elaborate on below, MGE and its neighboring utilities forecast the price of market energy to rise modestly in the mid- and long-term futures, essentially in step with gas

[34] MGE, "West Campus Cogeneration Facility". Attached as Ex-SC-Horowitz-11.
[35] Ex-SC-Horowitz-10.

prices. Meanwhile, the cost of energy from Iowa wind purchased today will remain steady at its LCOE in the low $30's, or less, per MWh. On a straightforward cost comparison basis, this means that wind energy will provide advantages compared to reliance on the market.

Q Is reliance on market energy riskier than reliance on wind generation?

A Yes, market energy is riskier than the known price of a Company-owned, near-zero variable cost, wind farm. The chance of the Saratoga Project's LCOE changing substantially from what the Company calculated in this case is low, as I discuss further below. Meanwhile, market energy is susceptible to both gradual price increases if fuel prices rise according to forecasts,[36] as well as unexpected spikes in price, such as that which occurred in the winter of 2014 due to the unexpectedly cold "Polar Vortex" season.

Q Has the Commission shown interest in Wisconsin utilities acquiring resources that might perform well compared to the market?

A Yes. PSCW Staff stated in the 2022 Strategic Energy Assessment that "the Commission will continue to evaluate and promote the potential for selling energy into the MISO market"[37] as a means of mitigating rate increases associated with capital investments. To the extent that wind energy will very likely be profitable compared to the market, near-term investments in wind provide exactly the sort of opportunity that the Commission has indicated utilities should bring before it.

Q How likely is it that wind generation will be profitable compared to the MISO market?

A. Very likely. Although market prices in MISO are currently quite low, the risk of these prices remaining so low that the Saratoga Project is not cost-effective is marginal. The project has substantial room for slower-than-expected growth in market prices before it would no longer be cost-effective. Figure 3 below shows the real value of the hourly

[36] For example, [redacted]

[37] 2022 SEA at p. 29. Attached as Ex-SC-Horowitz-12.

"profits" the Saratoga Project is projected to provide to MGE, calculated as the avoided cost of replacement energy purchases less the project's cost (generation multiplied by LCOE) on an hourly basis. The Saratoga Project is projected to be profitable as compared to the market in [redacted] from the late 2020s through the end of its useful life.

Figure 3. Hourly market revenues less resource costs (market profits) provided by Saratoga Project in Future 1, Scenario 1[38]

Other utilities in the Midwest, including Minnesota Power,[39] the Northern Indiana Public Service Company,[40] and DTE Energy[41] expect MISO market price increases roughly consistent with MGE's forecast in this case. However, again, I note that the Saratoga Project would be profitable even if market prices do not climb much beyond current levels. The Saratoga Project would slightly more than break-even in the event that market

[38] Ex-SC-Horowitz-13.
[39] Minnesota Power IRP, Appendix J at p. 3, attached as Ex-SC-Horowitz-14.
[40] NIPSCO 2016 IRP, Appendix A, Exhibit 3 at p. 52-53, attached as Ex-SC-Horowitz-15.
[41] DTE Electric Company Response to MECNRDCSCDE-1.1d in Case No. U-18255, attached as Ex-SC-Horowitz-16.

prices over the next 25 years average only $34.70/MWh—the average value of the MGE loadzone LMP from 2006 through 2016[42]—and market price increases even at the rate of inflation would lead to a net benefit of over $17 million based on the project's energy value alone.

Q Would purchase of additional fossil-fired capacity provide the same advantages as wind vis-à-vis the market?

A No, acquisition of fossil-fired generation cannot reduce the risk of market exposure or provide opportunities for energy market profits to the same extent as the purchase of a zero-variable-cost resource like wind. The price-setting resource in the MISO market is almost always a coal- or gas-fired resource (Figure 4).[43] Market prices will, therefore, rise if the cost to generate with either coal or gas increases. This could result from changes in fuel price, which are notoriously difficult to forecast with certainty. The cost of fossil generation could also rise due to regulatory requirements, such as limitations on carbon dioxide or other emissions. For example, MGE is party to a consent decree that required installation of a Selective Catalytic Reduction (SCR) system at the Columbia plant;[44] while this project had a large capital expense associated with it, SCR installation also increases the variable O&M cost of thermal plants and reduces their heat rates,[45] ultimately raising the variable cost of generation.

[42] As compared to the Saratoga Project LCOE of $31.61/MWh. The 2006–2016 average LMP value of $34.70/MWh is based on historical LMPs at the MGE.MGE loadzone pricing node, as sources from MISO's pricing report archive and included in Ex-SC-Horowitz-13. This value is approximately equal to the average of MGE's forecasted prices in years 2020 and 2021.

[43] The dark red bar in this figure represents the percent of hours in which coal is the price-setting resource, while the pale blue bar shows the same data for gas. In December of 2016, for example, coal was the price-setting resource in approximately 55 percent of hours while gas accounted for the bulk of the remainder.

[44] Joint Application of Wisconsin Power and Light Company, Wisconsin Public Service Corporation, and Madison Gas and Electric Company for a Certificate of Authority to Install a Selective Catalytic Reduction System at Columbia Energy Center Unit 2 in Docket 05-CE-143, excerpted in Ex-SC-Horowitz-17.

[45] For example, Columbia Unit 2's heat rate increased from 10,061 BTU/kWh to 10,119 BTU/kWh and its variable operation and maintenance costs increased from $19 million/year to $58 million/year. *Id.,* excerpted in Ex-SC-Horowitz-17.

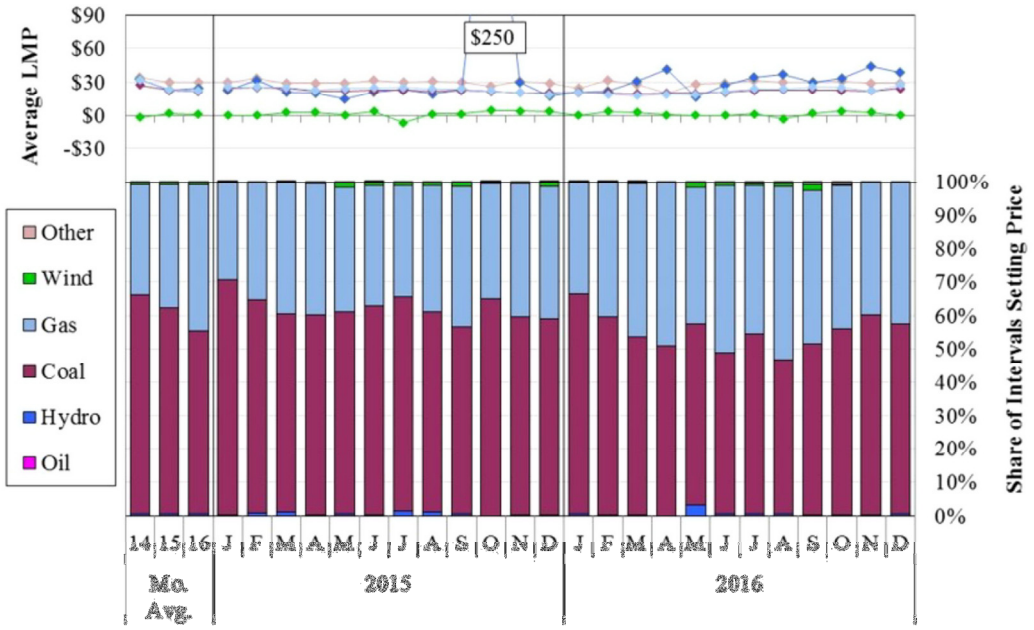

Figure 4. MISO price-setting resource by fuel type, 2015-2016[46]

Q What other factors are likely to pose a risk of rate increases to MGE's customers?

A As PSCW Staff stated in the 2016 Strategic Energy Assessment, "[r]ate increases are generally driven by sales decline, fuel price volatility and purchased power costs."[47]

Q Can addition of wind power soften these risks?

A Yes. The cost and approximate future generation level of wind power are known at the time the Company purchases it. These resources can, therefore, act as a powerful hedge against changing fuel prices and market or other purchased power costs. Even in the event that sales decline, wind power will likely provide a benefit to MGE's customers because it will likely be profitable against the market, meaning that MGE can sell its generation off-system as a source of revenue.

[46] Potomac Economics. "2016 State of the Market Report for the MISO Electricity Markets: Analytical Appendix". June 2017. Fig. A-5. Attached as Ex-SC-Horowitz-18.
[47] 2016 Strategic Energy Assessment at p. 4, attached as Ex-SC-Horowitz-19.

Q Apart from low market prices, are there any other factors that could impact the value of the wind power?

A Yes, performance-related factors could reduce the benefits provided by wind power. New wind facilities would suffer poor performance if their capacity factors were lower than expected or if their effective capacity factors were lower than expected due to curtailment.

Q Are these factors likely to impact the value of the Saratoga project, or reduce the benefits of additional Iowa wind projects?

A No. Wind capacity factors have been increasing in recent years, with average capacity factors now over 40 percent for new wind in the nation's interior.[48] Indeed, my own review of project capacity and generation found an average capacity factor of 38 percent in 2016 for large wind projects installed in Iowa in 2012[49]—a full seven years prior to the anticipated online date of the Saratoga Project. Because wind technology has seen further improvements in the recent past,[50] it is reasonable to expect even better performance from Saratoga and additional wind project than from these currently operational facilities.

Neither should curtailment present a major concern with regards to the value of additional wind to MGE's ratepayers. Wind in MISO has historically been curtailed at a rate of 2–6 percent of total resource (rather than by-project) output.[51] Nationally, wind curtailment reduced effective capacity factors by approximately 0.5–2 percent in 2016.[52] Meanwhile, MGE's modeling shows that Iowa wind is still cost-effective even at a capacity factor as low as [redacted] percent (a [redacted] percentage point drop compared to the Company's baseline assumption of the project performance).

[48] United States Department of Energy Office of Energy Efficiency and Renewable Energy. "2016 Wind Technologies Market Report". Figure 38. Attached as Ex-SC-Horowitz-20.
[49] Ex-SC-Horowitz-21.
[50] 2016 Wind Technologies Market Report. Figure 34. Attached as Ex-SC-Horowitz-20.
[51] 2016 Wind Technologies Market Report. Figure 32. Attached as Ex-SC-Horowitz-20.
[52] 2016 Wind Technologies Market Report. Figure 31. Attached as Ex-SC-Horowitz-20.

5. THE COMPANY SHOULD TAKE ADVANTAGE OF ALL REASONABLE OPPORTUNITIES TO PURCHASE WIND IN THE NEAR TERM

Q How might the wind market shift in the coming years?

A Capital costs for new wind resources are likely to continue to decline as the market develops, while capacity factors are likely to improve. These factors will work in favor of the cost-effectiveness of new wind resources. The impending phase-out of the PTC will work against cost-effectiveness of new wind. The ultimate balance of these competing trends is unclear at this time. Moreover, MGE may continue to face active competition from other utilities for the most favorable wind development sites. Therefore, the Commission should direct MGE to diligently monitor the cost and performance profiles of new resources available to it and should signal support for additional low-cost wind to remove any regulatory uncertainty that might delay the acquisition of additional wind. MGE should proactively pursue the best opportunities to quickly procure low-cost, high-performance wind as they become available.

Q Why should the Company not wait to purchase new resources until it faces a capacity or energy shortfall?

A The Company has an obligation to provide safe and reliable electric service to its customers at the lowest reasonably achievable cost. This obligation means that the Company should seek ways to minimize its costs at all times, rather than blithely assuming that its current strategy is the optimal until it faces an imminent capacity shortfall. For example, if the Company had an opportunity to switch to a substantially lower-cost fuel vendor for natural gas or coal without facing penalties for doing so, it would have a responsibility to ratepayers to pursue this option. The option of replacing market energy purchases with wind energy that is likely to be lower-cost over the mid- and long-terms is no different.

Q Can the Company avoid purchasing any resources in the near term?

A No. It is important to realize that the alternative to purchasing wind power is not neutrality. If the Company does not buy the Saratoga Project and additional near-term wind, it will instead buy market energy. The result of not acquiring more wind is, in

effect, requiring MGE to buy market energy for a significant portion of its energy need. As such, it is not the case that completion of the Saratoga Project, or procurement of additional wind generation, would provide facilities unreasonable in excess of MGE's probable future needs. Even though the pool of market energy available to MGE is likely adequate to meet its customers' needs, it does so at a cost greater than wind and with more inherent risk. MGE should only rely on the market to the extent that it is the cheapest and least-risk means of serving those needs—which, as my analysis above shows, is likely not the case.

Q How do near-term purchases of wind relate to the Company's Renewable Portfolio Standard compliance position?

A MGE projects that near-term purchases of wind energy will aid its RPS compliance position in [redacted].[53] The Company does not currently face a near-term RPS compliance gap. This is, however, largely irrelevant to the decision of whether or not to procure new wind resources. In the current market, wind competes as a low-cost energy resource rather than serving solely to meet RPS obligations.

Moreover, to balk at purchasing new renewable energy that is cost-effective on its merits because the Company does not have a current need for renewable energy credits (RECs) would be at cross-purposes with the aim of the RPS in the first place. RPS policies are intended to promote new markets for renewable resources and foster the development and growth of those markets. Ultimately, renewable resources are power generation facilities like any other. Once the market is at a sufficient scale, renewable resources can compete, and beat, other generation sources on their own merits. In other words, it is correct to say that the purpose of RECs is to encourage procurement of renewable energy, not that the purpose of renewable energy is to produce RECs.

Q Are the Saratoga project and future near-term wind purchases consistent with state policy goals?

A Yes. Most particularly, Wisconsin's state energy policy (Wis. Stat. § 1.12) states that:

[53] Ex.-MGE-Application-Confidential Appendix E at p. 39.

> It is the goal of the state that, to the extent that it is cost-effective and technically feasible, all new installed capacity for electric generation in the state be based on renewable energy resources, including…wind…and [other] resources.[54]

"Noncombustible renewable energy resources" such as wind generation are explicitly noted as the second most-preferred option (after energy efficiency) for "meeting energy demands"—inclusive of acquisition of resources to replace current sources of generation.[55] Acquisition of new wind is clearly technically feasible and, as discussed above, the evidence demonstrates that it is cost-effective as well. Procurement of new wind generation by the Company would, therefore, be directly in line with Wisconsin's clearly stated goals for the state's energy sector.

6. CONCLUSIONS AND RECOMMENDATIONS

Q Please summarize your conclusions and recommendations.

A In sum, I conclude that acquisition of at least [redacted] MW of new wind resources in the near term, including but not limited to the Saratoga Project, will likely provide substantial benefits to MGE's ratepayers in the form of lower energy costs and protection against market and fuel price swings. Because wind generation would primarily displace market purchases, additional high performance (greater than or equal to 40% capacity factor) wind facilities would not be unreasonably in excess of the Company's probable future requirements. Instead, such resources would likely lower the Company's cost of service. Indeed, I find that there is little likelihood that market prices would remain low enough to reverse the cost-effectiveness of near-term wind acquisitions. I observe that fossil fuel resources are incapable of providing the same hedging function as cost-effective wind. I also note that acquisition of additional renewable resources is in accordance with the state of Wisconsin's policy goals and that there is no reason to delay such acquisitions even without a need for additional RPS-compliant resources.

Based on these conclusions, I make the following recommendations to the Commission:

[54] Wis. Stat. § 1.12(3)(b).
[55] *Id.*, § 1.12(4)-(5).

1. I recommend that the Commission approve MGE's application for a Certificate of Authority to purchase and construct the Saratoga Project.
2. I also recommend that the Commission require MGE to seek 5 additional low-cost, high-capacity factor wind resources, as has been shown to be cost-effective in MGE's modeling for this case, in various sized blocks up to a total of at least [redacted] MW.
3. I recommend that the Commission direct MGE to diligently monitor the wind resources available to it and to proactively pursue additional opportunities to lower its generation costs through procurement of new wind.
4. Finally, I recommend that the Commission order MGE to report back to the Commission and parties about its progress towards acquiring additional wind and monitoring the wind resource market.

Q Does this conclude your direct testimony?

A It does.