STATE OF IOWA

BEFORE THE IOWA UTILITIES BOARD

IN RE:	)	DOCKET NO. RPU-2022-0001
MIDAMERICAN ENERGY COMPANY	)	
	)	SUPPLEMENTAL DIRECT TESTIMONY

PUBLIC VERSION
SUPPLEMENTAL DIRECT TESTIMONY OF

CHELSEA HOTALING

ON BEHALF OF ENVIRONMENTAL INTERVENORS

November 21, 2022

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- Confidential MidAmerican response to EI DR 115, "Planning-Confidential"

Hotaling Exhibit 3: MISO 2022/2023 PRA Results

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INTRODUCTION AND PURPOSE OF TESTIMONY

Q. Please state your name, business address, and position.

A. My name is Chelsea Hotaling. I am a Consultant at Energy Futures Group. My business address is 30 Court St., Canton, NY 13617.

Q. Please describe Energy Futures Group.

A. Energy Futures Group is a clean-energy consulting firm headquartered in Vermont with offices in Massachusetts and New York that provides specialized expertise on energy efficiency program design and policy, power system planning, and related topics.

Q. Please summarize your work experience and educational background.

A. I have worked for seven years in electric utility regulation and related fields. I have reviewed over a dozen integrated resource plans (IRPs) and related filings by utilities located in Arizona, Colorado, Kansas, Kentucky, Indiana, Michigan, Missouri, Montana, Minnesota, New Mexico, Nova Scotia, Puerto Rico, and South Carolina. I have performed my own capacity expansion and production cost modeling in numerous cases using the EnCompass software. I have reviewed planning modeling based on multiple models including EnCompass, Aurora, PLEXOS, PowerSimm, and System Optimizer. I have had formal training on the EnCompass, Aurora, and PowerSimm models. I have provided expert testimony to the Colorado Public Utilities Commission and the Michigan Public Service Commission.

I hold a B.S. in Accounting and Economics from Elmira College and a Master's in Business Administration, Master's in Data Analytics, and a Master's in Environmental

Policy and Governance from Clarkson University. My work experience is summarized in my resume, provided as Hotaling Exhibit 1.

Q. On whose behalf are you testifying in this proceeding?

A. I am testifying on behalf of the Environmental Intervenors.

Q. Have you testified previously before the Iowa Utilities Board?

A. No, I have not.

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

A. The purpose of my testimony is to present the results of my analysis of MidAmerican's proposed Wind PRIME resource additions. Specifically, I present the results of resource capacity expansion modeling designed to assess whether the Wind PRIME resource additions are reasonable compared to alternatives. I present an alternative resource portfolio that includes earlier coal plant retirements and replacement with renewables and battery storage resources in comparison to MidAmerican Energy Company's (MidAmerican or the Company) portfolio with the Wind PRIME projects and no consideration for earlier coal plant retirements.

Q. How is your testimony structured?

A. In Section I, I provide an overview of the EnCompass model and how the model was set up to perform the modeling to evaluate coal plant retirements and optimized replacement with renewable and battery storage resources. I discuss two scenarios modeled in order to assess the reasonableness of the Wind PRIME proposal: (1) MidAmerican's "proposed plan," which includes the Wind PRIME projects and continued operation of existing assets, including coal plants ("MidAmerican Preferred"); and (2) an alternative that

allowed the model to determine economic retirement dates for most coal units and to select cost effective replacement resources (Environmental Intervenors' Preferred Alternative or "EI Preferred Plan"). I also conducted a "low load" sensitivity to assess the potential that MidAmerican's load may not grow at its current aggressively forecasted rate. In Section II, I discuss the results of the modeling performed in EnCompass. In Section III, I provide my recommendations.

Q. Please summarize your key findings.

A. The modeling that I performed indicates that the Environmental Intervenor Preferred Plan, which includes a portion of the Wind PRIME projects, earlier coal retirements, and the economic addition of new resources (mostly storage but also wind and solar) is lower cost and has lower carbon emissions in comparison to the MidAmerican Preferred Plan.

Q. Please summarize your recommendations.

A. I recommend that the Board approve portions of the Wind PRIME projects detailed in my testimony below, and direct MidAmerican to conduct resource capacity expansion modeling to identify economic earlier retirement dates for the coal plants along with economic resource additions.

Q. What documents do you rely upon for your analysis, findings, and observations?

A. My analysis relies primarily upon the workpapers, exhibits, and discovery responses of MidAmerican's witnesses, attached as Exhibits, in addition to public sources of information.

I. ENCOMPASS MODELING

Q. Please explain the EnCompass model.

A. EnCompass is a capacity optimization and dispatch model developed by Anchor Power Solutions. Utilities that utilize EnCompass include Xcel Energy, Minnesota Power, Otter Tail Power, Great River Energy, the Public Service Company of New Mexico, Duke Energy, Tennessee Valley Authority, AES Indiana, and DTE Energy among others.[1]

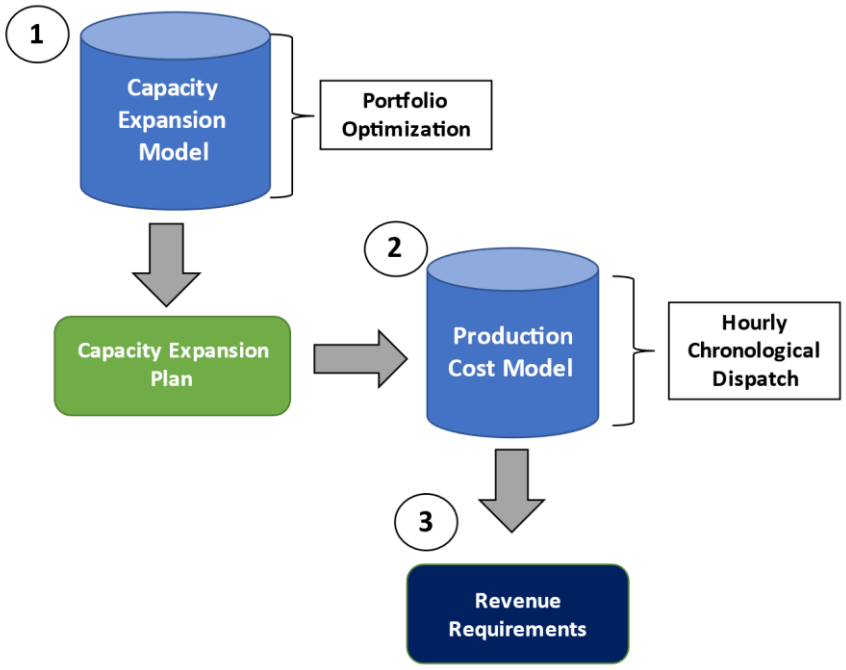
EnCompass has similar features to the Aurora model used by MidAmerican. EnCompass utilizes an optimization engine to optimize capacity expansion, unit commitment and dispatch, and market interaction. The EnCompass model is configured to perform both capacity expansion and production cost modeling for resource portfolios. For capacity expansion modeling, EnCompass will develop optimized portfolios that minimize system costs given the costs of new and existing resources, subject to constraints[2], such as the planning reserve margin (PRM). In addition, EnCompass can evaluate existing resources for economic retirement. Some of the modeling inputs include cost and operational constraints of the utility's existing and new resources, the load forecast, fuel forecasts, and the market price forecast.

Once a capacity expansion plan is developed, it is then passed onto the production cost side of the model to perform more granular dispatch of the utility's system.

[1] EnCompass is licensed by other non-utility entities such as independent power producers, and state regulatory bodies.
[2] Other constraints that can be set in the model include Renewable Portfolio Standards or specific emission reduction goals.

Figure 1 shows an illustration of how the optimized expansion plan from the capacity expansion step (step 1), is put through the 8,760 chronological production cost step (step 2), and then EnCompass reports the revenue requirements for each plan (step 3).

Figure 1. Illustration of Modeling in EnCompass



For the production cost modeling, EnCompass will simulate the operation of a portfolio on a chronological 8,760-hour basis in each year of the planning period specified in the model. EnCompass optimizes the chronological dispatch of the existing resources plus any new resources added from the capacity expansion step, along with market purchases, to meet the load across every hour of the planning period.[3] EnCompass reports the

[3] There may be some levels of unserved energy in the dispatch of plans if the load in any hour exceeds the existing and new resource generation plus market purchase limit (if an hourly limit is specified) in the model.

revenue requirements for each plan which allows plans to be compared against one another on a cost basis.

Q. How does EnCompass compare to Aurora?

A. The two software packages perform very similar functions. Both are capable of performing economic optimization of a portfolio of energy resources and of dispatching those resources in chronological, hourly simulations. The differences between the two are largely related to setup, model settings, the format of inputs, and reporting functionalities.

Q. Please explain the modeling that you performed using EnCompass.

A. I performed capacity expansion and production cost modeling using the EnCompass software to simulate resource decisions for MidAmerican over a planning period of 2022 through 2039. I evaluated two scenarios. The baseline scenario I call the "MidAmerican Preferred Plan", and it includes MidAmerican's plan to add all the Wind PRIME projects, MidAmerican's current coal plant retirement dates, and because MidAmerican did not evaluate any new resource additions beyond Wind PRIME for the analysis period, new resource additions selected by the model starting in 2030. The second scenario, called the "Environmental Intervenor Preferred Plan" or "EI Preferred Plan", includes earlier retirement of the coal plants and optimization of the addition of new clean energy resources starting in 2025. I included in this scenario approximately one third of the Wind PRIME wind resources and the 50 MW solar Wind PRIME project. The two scenarios are summarized in Table 1 below.

Table 1. Scenarios Modeled

Scenarios	Coal Retirements	Wind PRIME Projects	Replacement Resources
MidAmerican Preferred Plan	MidAmerican Dates	All Projects	Model may select economic additional new clean resources starting in 2030
Environmental Intervenor Preferred Plan	Optimized Economic Retirement of Louisa, Neal 3, and Ottumwa in 2025; retires Neal 4 in 2028, WSEC3 in 2031, WSEC 4 in 2034.	Approximately 1/3 of Wind PRIME wind and 50 MW solar[4]	Model may select economic additional new clean resources starting in 2025

Q. Please explain how you developed the inputs for the EnCompass model.

A. Through information provided in MidAmerican Witness testimony, exhibits, and discovery responses, along with some public information, I was able to set up modeling inputs to represent the operational parameters and costs for MidAmerican's existing resources, the Wind PRIME projects, and the new resources offered for selection within the model, as well as a representation of the MISO[5] market. I developed these assumptions in coordination with Devi Glick of Synapse, who is separately testifying in this proceeding.

shows the sources used to develop the modeling inputs for the EnCompass modeling. Modeling inputs include the load forecast, reserve margin, existing

[4] [redacted]

[5] Midcontinent Independent System Operator.

resource operational characteristics and costs, new resource costs and operational characteristics, capacity purchases and sales, and energy market prices.

Table 2. Modeling Input Assumptions[6]

Modeling Input	**Source**
Load Forecast	Confidential MidAmerican response to IBEC DR 22
Market Prices	Confidential MidAmerican response to Tech DR 11
Market Import/Export Limit	MISO 2022/2023 Planning Resource Auction Results
Capacity Purchase Price	MISO 2022/2023 Planning Resource Auction Results
Capacity Sale Price	Confidential MidAmerican response to OCA DR 8A
CO_2 Price Forecast	Confidential MidAmerican Witness Hammer Direct Exhibit 3
Reserve Margin	MidAmerican Witness Hammer Direct Testimony (Table 3, p. 18)
Existing/Planned Solar Profile	Confidential MidAmerican response to IUB DR 15
Existing/Planned Wind Profile	Confidential AEO MidAmerican response to IUB DR 25
Existing Other Renewable Profile	EIA Form 923
Existing Renewable Firm Capacity	MidAmerican Witness Hammer Direct Testimony (Table 2, p. 11)
Thermal Operating Parameters and Costs[7]	Confidential MidAmerican response to EI DR 31 and EIA Form 923
Thermal and Nuclear Fuel Prices	Confidential MidAmerican response to EI DR 31
Coal Plant Fixed O&M and Capital Expenditures[8]	Confidential MidAmerican response to EI DR 47C
Existing Resource Retirements	Confidential MidAmerican response to IBEC DR 01
Demand Side Resources	Confidential MidAmerican response to IBEC DR 01
Wind PRIME Project Cost	Confidential MidAmerican Witness Specketer

[6] Hotaling Exhibits 2 – 3.
[7] Includes fuel costs, fixed and variable operations and maintenance costs, capital expenditures, maximum and minimum capacity, heat rate, forced outage rates, and carbon emission rates.
[8] Glick Confidential Exhibit 32.

	Rebuttal Exhibits 1-3
Wind PRIME Profile for Solar and Wind	Confidential AEO MidAmerican response to EI DR 169a and 170a
New Battery Storage Cost	NREL 2022 ATB Moderate Cost Curve
New Wind and Solar Cost	Start with Wind PRIME capital cost then NREL ATB Moderate Cost Curve applied for remainder of modeling period
New Wind and Solar Interconnection Costs	Confidential MidAmerican response to EI DR 115
New Wind and Solar Firm Capacity	MidAmerican Witness Hammer Direct Testimony (p.16)
New Solar and Wind Profile	Confidential AEO MidAmerican response to EI DR 169a and 170a
Weighted Average Cost of Capital	MidAmerican Witness Specketer Direct Testimony (p. 26)
Tax Rate	MidAmerican Witness Specketer Direct Testimony (p. 26)

Q. Please explain your assumptions regarding MidAmerican's existing generation.

A. For MidAmerican's Preferred Plan, we assumed that MidAmerican's coal generation and other existing generation continues to operate through current planned retirement dates. We also modified two assumptions related to the retirement of the Quad Cities nuclear units and MidAmerican's peaking units. Instead of retiring the Quad Cities units at the [redacted], we assumed that the units continued to operate through the planning period modeled. This assumption was made based on the information included in MidAmerican's discovery response[9], which indicated that the owner of the units, Constellation, announced in January 2022 its intent to seek relicensing of the units in 2027. The retirement information contained in MidAmerican's confidential response to IBEC DR 01[10] indicated that [redacted] would retire by the end of

[9] Glick Exhibit 32, MidAmerican response to Tech Data Request 5.
[10] Guyer Exhibit 2.

[redacted]

Q. Please summarize your assumptions regarding the Wind PRIME projects.

A. The assumptions for the Wind PRIME projects reflect the changes to the project size and in-service dates provided in Witness Jablonski's Rebuttal testimony. Consistent with Mr. Jablonski's testimony, we included [redacted] MW of wind coming online in 2023, and [redacted] MW of wind and [redacted] MW of solar in 2024.[11] [redacted]

Q. Please explain your cost assumptions for new resources, as well as how you accounted for cost changes resulting from the passage of the Inflation Reduction Act.

A. Starting in 2025, the model was allowed to select economic new resources including wind, solar, 4-hour battery storage, and 10-hour battery storage. Starting in 2030, the model could also select a proxy clean firm resource that was modeled with costs and operating characteristics similar to a combustion turbine (CT), but without the associated emissions. This resource was designed to capture the potential benefits of adding long duration storage. All costs for new resources were derived from the 2022 National Renewable Energy Lab Annual Technology Baseline (NREL ATB), which is a standard

[11] MidAmerican Witness Jablonski Rebuttal testimony, pages 11-12.

industry resource.[12] However, the starting capital cost for generic new wind and solar resources were based on the starting capital cost from the Wind PRIME projects and then the Moderate cost curve from the NREL ATB was applied to develop costs for the remainder of the planning period. This modification was made to account for recent inflationary and supply chain pressures that have resulted in short term cost increases for new solar and wind projects. The capital cost for the solar and wind projects in Wind PRIME are comparable to average prices I have seen for new wind and solar resources in other jurisdictions. To capture the changed economics of resources resulting from the passage of the Inflation Reduction Act (IRA), we included the same assumptions that MidAmerican utilized for the Wind PRIME wind and solar projects. In Rebuttal testimony, Witness Fehr[13] indicated that MidAmerican assumed that both the wind and solar projects for Wind PRIME would qualify for the 100%[14] production tax credit (PTC) under the IRA. We included the assumption that new wind and solar resources that were offered for selection in the EnCompass model would qualify for 100% of the PTC value through 2033, with a phasedown to 75% of the PTC in 2034, and 50% in 2035.

We also allowed the model to select either 4-hour or 10-hour battery storage resources and incorporated the impact of the IRA tax credits on those resources. Witness Fehr alluded to the economic benefit under the IRA for battery storage resources when he said, "It should also be noted that the economic benefits available to energy storage have also

[12] NREL (National Renewable Energy Laboratory). 2022. "2022 Annual Technology Baseline." Golden, CO: National Renewable Energy Laboratory.
[13] MidAmerican Witness Fehr Rebuttal testimony, pages 3-4.
[14] The 100% PTC assumption includes the 20% base PTC with the five times Prevailing Wage and Labor Multiplier.

been enhanced through an investment tax credit the IRA makes available for energy storage."[15] We also included a 30%[16] investment tax credit (ITC) for new battery storage resources. Table 3 provides the levelized costs modeled for new solar, wind, and 4-hour battery storage resources that reflect the impact of the IRA.

Table 3. Cost Assumptions for New Generic Solar, Wind, and Battery Storage Resources[17] (Nominal Dollars)

Year	Solar ($/MWH)	Wind ($/MWH)	4-Hour Battery Storage ($/kW-Mo)
2025	$50.21	$31.28	$8.67
2026	$48.21	$30.21	$8.55
2027	$46.08	$29.07	$8.46
2028	$43.80	$27.84	$8.31
2029	$41.38	$26.54	$8.23
2030	$38.80	$25.14	$8.15
2031	$39.05	$25.17	$8.29
2032	$39.30	$25.18	$8.43
2033	$39.53	$25.18	$8.57
2034	$47.03	$32.44	$9.36
2035	$58.70	$43.86	$10.17
2036	$71.03	$55.95	$11.67
2037	$72.14	$56.81	$11.86
2038	$73.26	$57.68	$12.05
2039	$74.40	$58.56	$12.24

Q. Please explain how the MidAmerican system interacts with the MISO market in EnCompass.

A. The model was set up to simulate MidAmerican's system with an interaction with the MISO market. The hourly import and export limit inputs were developed based on the

[15] MidAmerican Witness Fehr Rebuttal testimony, page 14.
[16] The 30% ITC assumption includes the 6% base ITC with the five times Prevailing Wage and Labor Multiplier.
[17] Hotaling Exhibit 4.

MISO import and export limits for Zone 3 from the 2022/2023 MISO Planning Resource Auction (PRA) results.[18] Based on MidAmerican's peak load relative to the rest of Zone 3, we apportioned 50% of the import and export limit to MidAmerican. The interaction with the MISO market within the model also allows for assumptions around the purchase and sale of capacity. We allowed the model to purchase up to 100 MW of capacity and to sell up to 50 MW of capacity in any year of the planning period. The capacity purchase price was based on the 2022/2023 MISO PRA results, which reached the Cost of New Entry (CONE).[19] The capacity sale price was based on MidAmerican's assumptions.[20]

Q. Please explain the source of energy market prices used to conduct this modeling.

A. We utilized the hourly market price forecast provided by MidAmerican in its response to Confidential Tech DR 11[21]. We used the hourly prices with the Wind PRIME projects for both the MidAmerican Preferred Plan and the Environmental Intervenor Preferred Plan since it is our understanding that the Wind PRIME projects will be developed, even if MidAmerican does not receive approval for the Wind PRIME projects.[22]

Q. Please explain if you evaluated any sensitivities on the MidAmerican and Environmental Intervenor Preferred Plans.

A. We evaluated each plan under a low load sensitivity. The low load sensitivity assumed a slower rate of growth for MidAmerican's load forecast[23] between 2024 and 2039. The

[18] Hotaling Exhibit 3.
[19] Hotaling Exhibit 3.
[20] Glick Exhibit 32, Confidential MidAmerican response to OCA DR 8a.
[21] Glick Exhibit 32.
[22] MidAmerican Witness Fehr Rebuttal testimony, pages 7-8; MidAmerican Witness Brown Direct Testimony, page 11.
[23] Glick Exhibit 10, Confidential MidAmerican response to IBEC DR 22.

low load sensitivity assumed an average annual growth rate of [redacted] between 2024 and 2029 and then an average annual growth rate of [redacted] between 2030 and 2039. The base and low load forecasts are depicted below in Figure 2. The average annual growth rate for the "MidAmerican Base" is [redacted] and the average annual growth rate is [redacted] for the "Low Load Sensitivity". The low load sensitivity is intended to assess the impact of MidAmerican's load growing at a lower rate than the utility currently projects, and also the potential impact of the implementation of additional demand side resources that could provide energy and demand reduction.

The low load sensitivity was conducted for both the Environmental and the MidAmerican Preferred Plan. Each plan was re-optimized for new resource additions using the low load forecast developed for this sensitivity. The coal retirements modeled in the Environmental Intervenor Preferred Plan remained fixed under the low load sensitivity.

Figure 2. Confidential Base and Low Load Growth[24]

Q. Did you have to set up any constraints in the model?

A. Yes, I did. Initial modeling runs of the Environmental Intervenor Preferred Plan and the MidAmerican Preferred Plan resulted in the addition of significant amounts of battery storage resources between 2025 and 2027. I placed an annual constraint in the model allowing it to select no more than 500 MW of four-hour battery storage in each year between 2025 and 2027 for the Environmental Intervenor Preferred Plan. Initial modeling runs of MidAmerican's Preferred Plan that allowed the model to add additional economic resources without constraint also showed the model wanted to add significant amounts of battery storage beginning in 2025. Since MidAmerican's analysis is not considering new resource additions outside of Wind PRIME, I had to

[24] Base forecast developed from Glick Exhibit 10.

constrain the model to prevent it from selecting any resources until 2030 in the MidAmerican Preferred Plan. However, even with that change, the model still found it optimal to significantly overbuild MidAmerican's system with additional new resources between 2030 and 2039, especially battery storage resources. I then had to place additional annual constraints on how many battery storage resources could be added for the MidAmerican Preferred Plan. I made these constraints in anticipation of a critique from MidAmerican that our modeling run of its preferred plan resulted in an overbuilt system.

II. MODELING RESULTS

Q. Please explain how you modeled the early coal retirement dates for the Environmental Intervenor Preferred Plan.

A. The model found it was economic to retire Louisa, Ottumwa and Neal 3 in the first year it was allowed to do so, which was 2025. The Plan also includes retirement dates of 2028 for Neal 4, 2031 for WSEC 3, and 2034 for WSEC 4. The model was allowed to determine economically when to add new clean energy resources, starting in 2025. The Environmental Intervenor Preferred Plan included the following retirement dates for MidAmerican's coal units, as shown in Table 4.

Table 4. Early Retirement Dates for Coal Plants

Coal Plant	Environmental Intervenor Preferred Plan
Ottumwa	12/31/2025
Neal 3	12/31/2025
Louisa	12/31/2025
Neal 4	12/31/2028
Walter Scott 3	12/31/2031
Walter Scott 4	12/31/2034

Assuming the retirement of the coal plants in the years identified in Table 4 and the additions of a portion of Wind PRIME wind and 50 MW of Wind PRIME solar, and using MidAmerican's projected load growth and the retirement dates for other existing units shown in Table 2, above, the model found it economic to add a mixture of 4-hour battery storage, solar, wind resources, and limited amounts of capacity purchases over the planning period. Table 5 below shows the annual expansion plan for the Environmental Intervenor Preferred Plan between 2025 and 2039.

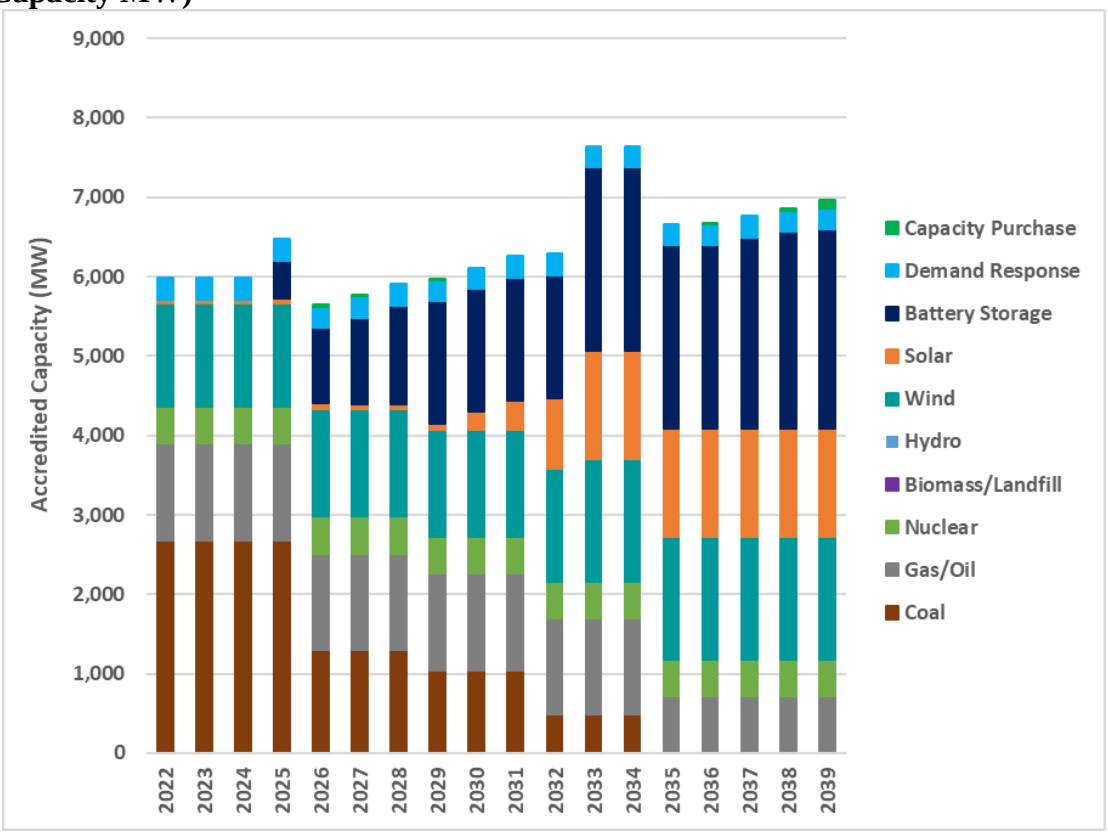
Table 5. Environmental Intervenor Preferred Expansion Plan (MW)

Year	4-HR Battery	Solar PV	Wind	Capacity Purchase
2025	500	0	0	0
2026	500	0	0	19
2027	140	0	0	0
2028	160	0	0	0
2029	329	0	0	0
2030	0	450	0	0
2031	0	400	0	0
2032	0	1500	0	0
2033	805	1350	750	0
2034	0	0	0	0
2035	0	0	0	0
2036	0	0	0	0
2037	106	0	0	0
2038	74	0	0	30
2039	31	0	0	100

Figure 3 and Figure 4 show the annual firm capacity[25] and generation for the Environmental Intervenor Preferred Plan. In the Environmental Intervenor Preferred Plan, all coal is retired by the end of 2034. The capacity is replaced with a mixture of new battery storage, solar, and wind resources. Wind continues to make up a large portion of MidAmerican's total generation throughout the planning period. Generation from solar resources increases throughout the planning period as more solar resources are added between 2030 and 2033.

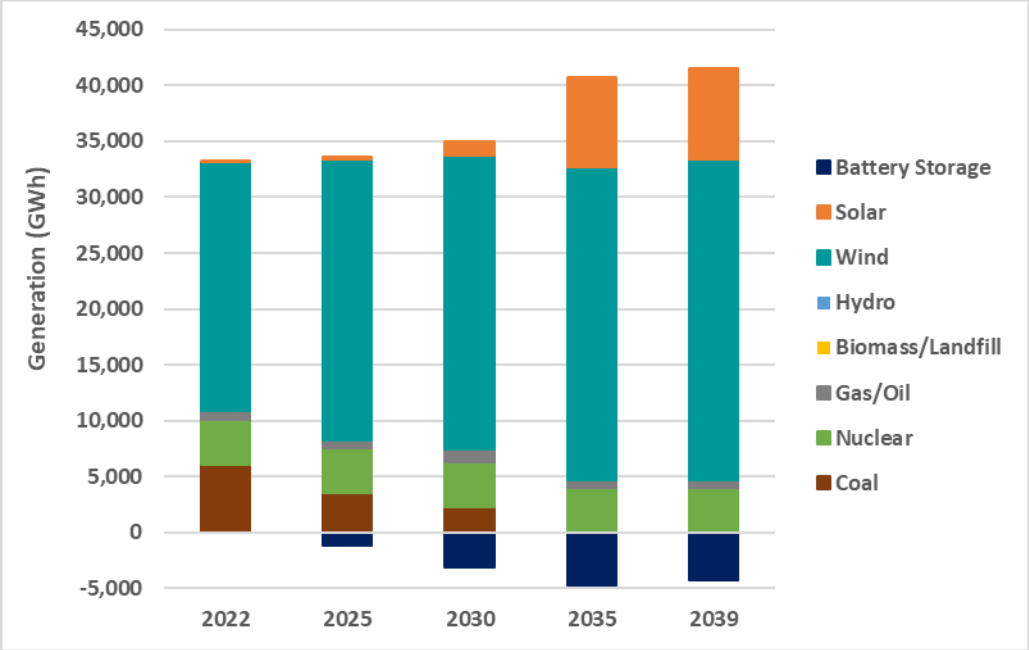
[25] EnCompass uses the term "Firm Capacity" to represent the accredited capacity of resources.

Figure 3. Environmental Intervenor Preferred Plan - Changes in Firm Capacity MW)[26]



[26] Hotaling Exhibit 5.

Figure 4. Environmental Intervenor Preferred Plan Generation (GWh)[27]



Q. Please summarize the results of the MidAmerican Preferred Plan.

A. We allowed new resource additions selected by the model starting in 2030 because MidAmerican did not evaluate any new resource additions beyond Wind PRIME for the analysis period. We know that there will be future resource needs under Wind PRIME and that those resources will come with their own costs. Not modeling those resources would create an artificially low cost comparison. For the MidAmerican Preferred Plan, the model added 4-hour battery storage and solar as soon as I lifted the constraint preventing new resource selection, which was 2030. Table 6 shows the annual expansion plan for the MidAmerican Preferred Plan between 2030 and 2039.

[27] Hotaling Exhibit 5.

Table 6. MidAmerican Preferred Expansion Plan (MW) – Additional New Generic Resources

Year	Battery	Solar PV	Wind
2030	125	0	0
2031	125	0	0
2032	125	0	0
2033	125	950	0
2034	250	0	0
2035	551	0	0
2036	0	0	0
2037	0	0	0
2038	0	0	0
2039	0	0	0

Figure 5 and Figure 6 show the annual firm capacity and generation for existing and generic new resources added to the MidAmerican Preferred Plan, respectively. Again, the model wanted to add battery storage starting in 2025, but I constrained the model from doing so to prevent a significant overbuilding of MidAmerican's system. In this scenario, MidAmerican's capacity mix looks largely the same as it does today, except for the additional wind from the Wind PRIME projects and the new battery storage and solar that is added to serve load growth. Wind continues to be the largest generation source for MidAmerican's system, with generation increasing through [redacted] as the Wind PRIME projects come online. [redacted].

Figure 5. Confidential MidAmerican Preferred Plan Firm Capacity (MW)[28]

[28] Hotaling Exhibit 5.

Figure 6. Confidential MidAmerican Preferred Plan Generation (GWh)[29]

Q. Please summarize how the costs compare between the Environmental Intervenor and MidAmerican Preferred Plans.

A. When comparing the costs of the Environmental Intervenor Preferred Plan and MidAmerican Preferred Plan, the Environmental Intervenor Preferred Plan has a lower Present Value of Revenue Requirement (PVRR). Table 7 shows the Net Present Value (NPV) results for both plans and the delta in cost between the plans.

Table 7. NPV Results ($000)[30]

Plan	Total NPV	Delta
Environmental Intervenor	$4,851,288	-$121,020
MidAmerican Preferred	$4,972,308	

[29] Hotaling Exhibit 5.
[30] Hotaling Exhibit 5.

Table 8 below shows the comparison of the Environmental Intervenor and MidAmerican Preferred Plan for the different cost and revenue categories that flow into the PVRR for each plan. The Environmental Intervenor Preferred Plan has savings for fuel, carbon emissions, and non-fuel variable costs.

Table 8. Confidential NPV of PVRR Cost and Revenue Categories ($000)

	Environmental Intervenor	MidAmerican	Difference
Fuel Costs ($000)	$1,043,143	[redacted]	[redacted]
Program Costs ($000)[31]	$134,689	[redacted]	[redacted]
Non-Fuel Variable Cost ($000)[32]	$2,028,312	[redacted]	[redacted]
Fixed Cost ($000)[33]	$2,325,080	[redacted]	[redacted]
Contract Cost ($000)[34]	$6,600	[redacted]	[redacted]
Purchase Cost ($000)	$1,508,294	[redacted]	[redacted]
Sales Revenue ($000)	$2,187,959	[redacted]	[redacted]
Contract Revenue ($000)	$6,872	[redacted]	[redacted]
Total PVRR	**$4,851,288**	**$4,972,308**	**-$121,020**

Table 9 provides a breakdown of the cost difference for the operation of the coal plants under the Environmental Intervenor and MidAmerican Preferred Plans.

[31] Program costs account for the carbon emission cost modeled.
[32] Non-Fuel Variable Cost includes the variable O&M for existing resources, the cost of Wind PRIME projects, and the costs of new generic solar and wind.
[33] Fixed Costs include the fixed O&M for existing resources, the coal plant capital expenditures, and the costs of new battery storage resources.
[34] Contract refers to the purchase or sale of capacity.

Table 9. Confidential NPV Comparison of Coal Costs ($000)

	Environmental Intervenor	MidAmerican
Total Coal Costs	[redacted]	[redacted]
Fuel	[redacted]	[redacted]
Variable O&M	[redacted]	[redacted]
Fixed O&M and Capex	[redacted]	[redacted]
Carbon	[redacted]	[redacted]

Q. How did the level of curtailments compare between the Environmental Intervenor and MidAmerican Preferred Plan?

A. The MidAmerican and Environmental Intervenor Preferred Plans begin to see a significant difference in curtailment between 2024 and 2032. The addition of the entire Wind PRIME capacity in the MidAmerican Preferred Plan drives the increase in curtailment seen below in Figure 7. In contrast, the Environmental Intervenor Preferred Plan sees declining levels of curtailment between 2025 and 2030 as more battery storage resources are added in the expansion plan. The Environmental Intervenor Preferred Plan does see some increase in curtailment starting in 2032 as more solar comes online in 2032 and 2033. The curtailments in the MidAmerican Preferred Plan do see reductions throughout the planning period, especially once the battery storage resources come online between 2030 and 2039.

Figure 7. Confidential Comparison of Annual Levels of Curtailment (GWh)[35]

Q. Can you explain the model wanting to select battery storage resources in the expansion plan?

A. One of the reasons why the model is selecting new battery storage is that battery storage resources become even more cost-effective with the ITC provision from the IRA. The battery storage resources also have a higher accreditation when compared to wind and solar resources. MidAmerican also has a significant amount of wind resources on its system and battery storage resources can store energy that otherwise would have been curtailed during periods of high renewable output.

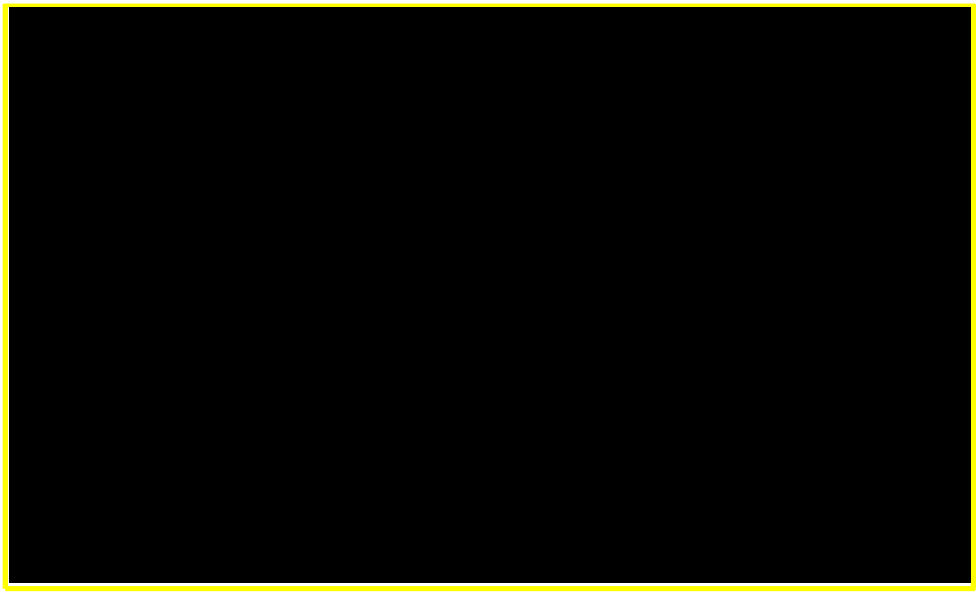
[35] Hotaling Exhibit 5.

Q. Please explain how the CO_2 emissions compare for the Environmental Intervenor and MidAmerican Preferred Plan.

A. Figure 8, below, shows the comparison of the cumulative emissions in both the Environmental Intervenor and MidAmerican Preferred Plans. The Environmental Intervenor Preferred Plan begins to have lower cumulative emissions starting in 2026, as the coal plants start to retire. Prior to 2026, the model reflects lower CO_2 emissions under MidAmerican's Preferred Plan because the Wind PRIME projects reduce generation from the coal plants. However, our understanding is that the Wind PRIME projects will be built regardless of who owns them[36], and so these short-term CO_2 benefits should occur under either scenario. By 2035, all the coal plants are retired in the Environmental Intervenor Preferred Plan, resulting in significantly lower CO_2 emissions than the MidAmerican Preferred Plan. Note that in the model, I assumed all coal plants were allowed to operate economically, rather than in "must run" status. This is [redacted]. It does not, however, necessarily reflect reality. Many utilities run their coal plants regardless of whether it would be more economic to ramp them down or shut them off entirely, known in MISO as "self-commit" or "must run" offers. The full CO_2 (and economic) benefits shown in both scenarios will only be captured to the extent MidAmerican does not "must run" its coal plants.

[36] Brown Direct at 11.

Figure 8. Confidential Cumulative CO_2 Emissions (Tons)[37]



Q. Please summarize the results of the low load sensitivity.

A. Table 9 shows the cumulative expansion plan difference (2025-2039) for the Environmental Intervenor Preferred Plan under the base and low load forecasts. The difference shows the reduced build for battery storage resources, solar, and wind, in addition to a lower amount of capacity purchases under the low load forecast.

Table 9. Environmental Intervenor Cumulative Expansion Plan Additions Under Low Load Sensitivity (MW)[38]

	Battery	Solar PV	Wind	Capacity Purchase
Base Load	2645	3700	750	149
Low Load	2442	3100	100	2
Difference	-202	-600	-650	-146

[37] Hotaling Exhibit 5.
[38] Hotaling Exhibit 6.

Table 10 shows the cumulative expansion plan difference (2030-2039) for the MidAmerican Preferred Plan under the base and low load forecasts. The difference shows the reduced build for battery storage resources and solar resources under the low load forecast.

Table 10. MidAmerican Cumulative Expansion Plan Under Low Load Sensitivity (MW)[39]

	Battery	Solar PV	Wind	Capacity Purchase
Base Load	1301	950	0	0
Low Load	1250	0	0	6
Difference	-51	-950	0	6

When comparing the costs of the Environmental Intervenor Preferred Plan and MidAmerican Preferred Plan under the low load sensitivity, the Environmental Intervenor Preferred Plan has a lower PVRR. Table 11 shows the PVRR results for both plans and the delta in cost between the plans for the low load sensitivity.

Table 11. NPV Results ($000) for Low Load Sensitivity[40]

Plan	Total NPV	Delta
Environmental Intervenor	$4,213,221	-$157,415
MidAmerican	$4,370,635	

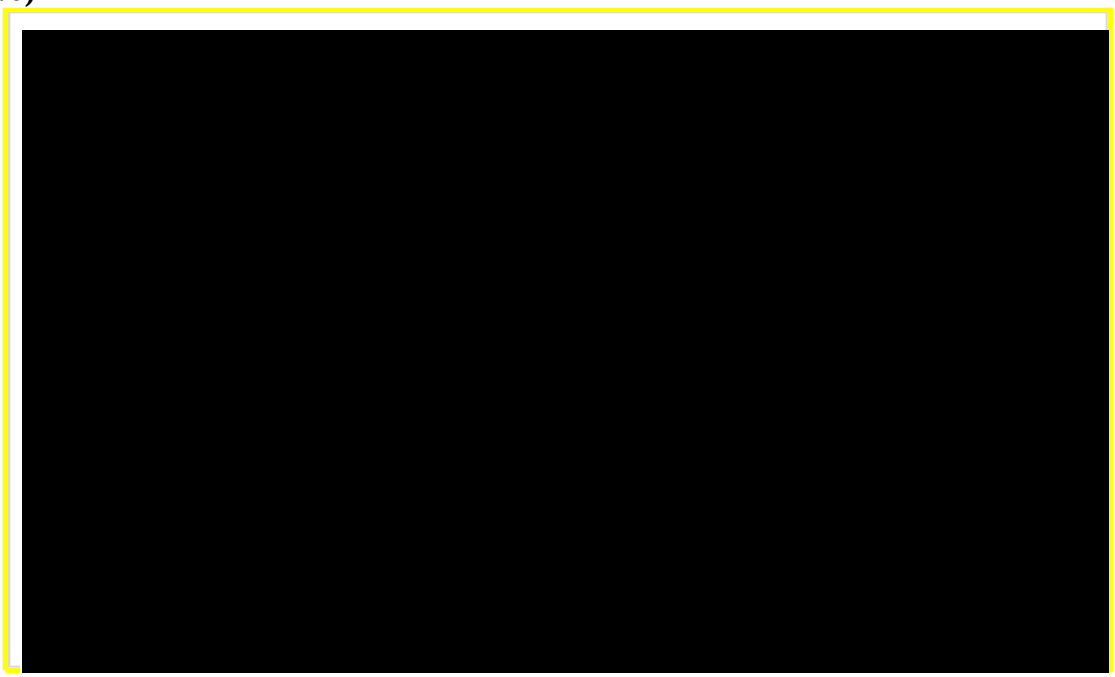
Q. Did your modeling of MidAmerican's Preferred Plan find [redacted] for [redacted]?

A. Yes, it did. The MidAmerican Preferred Plan [redacted]. Figure 9 below shows

[39] Hotaling Exhibit 6.
[40] Hotaling Exhibit 6.

the comparison of the average annual capacity factor across all coal plants for the MidAmerican Preferred Plan and the modeling results put forward by MidAmerican ("MidAmerican Analysis"). The MidAmerican Analysis shows [redacted] between 2022 and 2032 when compared to the MidAmerican Preferred Plan. It is possible that this difference is the result of [redacted] which would result in [redacted] The modeling run I performed for the "MidAmerican Preferred" assumed that all the coal plants could be economically dispatched. After 2033, both analyses show a similar pattern of the [redacted]. It is important to note that the modeling results show [redacted]

Figure 9. Confidential Comparison of Average Coal Plant Capacity Factors (%)[41]



Q. Does your modeling reflect the changes recently approved by the Federal Energy Regulatory Commission to MISO Resource Adequacy (RA) requirements?

A. No, it does not. At the time that I started to build the EnCompass database and perform modeling, MISO had not released[42] anticipated seasonal reserve margin requirements nor seasonal accreditation values for solar and wind resources. I also did not have the information necessary to determine what the seasonal accredited values of MidAmerican's thermal fleet or what MidAmerican's seasonal coincidence factor with the MISO system peak might for each season. Both the reserve margin and accredited value of resources are key inputs to the modeling. Given the importance of these inputs, and the lack of data needed to fully incorporate the MISO seasonal construct into the

[41] Hotaling Exhibit 5.
[42] MISO has provided information related to preliminary solar and wind accreditation values, but final values were not published at the time that I started performing modeling.

modeling, I did not attempt to reflect the seasonal resource adequacy requirements for this project.

Q. Does this mean that your modeling presents a resource plan that cannot meet the new MISO RA requirements?

A. Not necessarily – it's not possible to say without doing the calculation using the data described above. Both the Environmental Intervenor and the MidAmerican Preferred Plan do add solar resources, but those builds begin during the 2030-2033 timeframe and are not immediate new resource builds. Figure 9 below shows the seasonal accreditation for wind and solar that has been released by MISO.

Figure 10. MISO Seasonal Accreditation for Wind and Solar Resources[43]

	Wind ELCC %	Solar ELCC %
Summer	18.1%	45.4%
Fall	23.1%	25.3%
Winter	40.3%	6.3%
Spring	23.0%	15.0%

Given the large amount of wind in MidAmerican's capacity mix, the existing wind resources will provide significant accreditation for the winter season.

The primary new resource builds prior to 2030 in the Environmental Preferred Plan include 4-hour battery storage resources. As MidAmerican witness Hammer implied in

[43] Hotaling Exhibit 7.

his Rebuttal testimony,[44] battery resources are not impacted by the movement to a seasonal construct. The accreditation of any resource in MidAmerican's current or projected portfolio is subject to revision, however, and so it will be important for MidAmerican to clearly provide the data necessary for this determination in the future, i.e., the coincidence factors or the seasonal accredited values of its existing fleet.

III. CONCLUSION AND RECOMMENDATIONS

Q. Please state your recommendations.

A. I recommend that the Board approve approximately one third of the Wind PRIME wind and the 50 MW Wind PRIME solar project in addition to directing MidAmerican to conduct resource capacity expansion modeling to identify economic earlier retirement dates for the coal plants and economic resource additions.

Q. Does this conclude your testimony?

A. Yes.

[44] MidAmerican Witness Hammer Rebuttal Testimony, Figure 5, page 19.

AFFADAVIT OF CHELSEA HOTALING

STATE OF ILLINOIS) ss.
COUNTY OF COOK)

I, Chelsea Hotaling, being first duly sworn on oath, state that I am the same Chelsea Hotaling identified in the testimony being filed with this affidavit, that I have caused the testimony to be prepared and am familiar with its contents, and that the testimony is true and correct to the best of my knowledge and belief as of the date of this affidavit.

/s/ Chelsea Hotaling
Chelsea Hotaling

State of Illinois County of Cook
Subscribed and sworn before me the 18th day of November, 2022.

/s/ Heather Vogel
Notary Public in and for the
State of Illinois