STATE OF IOWA

BEFORE THE IOWA UTILITIES BOARD

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

DIRECT TESTIMONY OF STEVEN C. GUYER ON BEHALF OF ENVIRONMENTAL LAW & POLICY CENTER IOWA ENVIRONMENTAL COUNCIL SIERRA CLUB

JULY 29, 2022

I. INTRODUCTION

Q: Please state your name, business name and address, and role in this proceeding.

A: My name is Steven C. Guyer. I am the Energy Policy Manager with the Iowa Environmental Council, located at 505 Fifth Ave, Suite 850, in Des Moines, Iowa. I appear here in my capacity as a witness on behalf of the Environmental Law and Policy Center, the Iowa Environmental Council, and Sierra Club (collectively "Environmental Intervenors").

Q: Please describe your background.

A: I have an Associate of Arts degree in Electronics Engineering from Hawkeye Institute of Technology in Waterloo, Iowa, a Bachelor of Arts degree in Physics from the University of Northern Iowa in Cedar Falls, Iowa, and a Juris Doctorate from the University of Iowa in Iowa City, Iowa. I was admitted to practice law by examination in Iowa in 1988 and maintain my licensure. Since 1988, I have been working in the energy field. From 1988 through 2007, I worked in legal and environmental positions at Iowa Southern Utilities, IES Industries, Alliant Energy, and MidAmerican Energy. Since 2008, I have designed and built solar energy systems across Iowa as the owner and president of GWA Solar. In addition to my continued work at GWA Solar, I have worked for the Iowa Environmental Council (IEC) since 2019. The Iowa Environmental Council is a 501(c)(3) non-profit, member-based corporation that works to advance public policies that provide a safe, healthy environment and sustainable future for all Iowans. In my capacity at IEC, I work primarily on renewable energy, and energy

and climate policy.

Q: Have you testified with the Iowa Utilities Board before?

A: Yes. Most recently I testified in Docket No. RPU-2021-0003, the application for advanced rate making principles submitted by Interstate Power and Light, Docket No. EPB-2020-0150, the emission plan and budget proceeding for Interstate Power and Light, and Docket No. EPB-2020-0156, the emission plan and budget proceeding for MidAmerican Energy.

Q: What is the purpose of your testimony?

A: The purpose of my testimony is to evaluate the reasonableness of the Wind PRIME proposal (adding 2042 MW of wind generation and 50 MW of solar generation) to MidAmerican's system. My testimony examines the question of whether MidAmerican "has considered other sources for long-term electric supply" and whether it has shown that the proposed addition "is reasonable when compared to other feasible alternative sources of supply." IOWA CODE § 476.53; 199 IAC 41.3. I will go through MidAmerican witness Hammer's nine-step qualitative analysis of the value of the Wind PRIME proposal, including cost; cost robustness; environmental reasonableness; electric supply reliability; fuel diversity and flexibility/optionality; availability/maturity; and addressing customer renewable energy goals. I separately evaluate the reasonableness of MidAmerican's proposed technology study. I find that the study is unduly risky for customers, is not an appropriate use of advanced ratemaking principles, and should be disapproved by the Board.

Q: Are you sponsoring exhibits with your testimony?

A: Yes. I am sponsoring the following exhibits:

- Guyer Exhibit 1 (confidential) – MidAmerican Projected CO2 Emissions;
- Guyer Exhibit 2 (confidential) – MidAmerican Response to IBEC DR 1 (Confidential Attachment)
- Guyer Exhibit 3 (confidential) – MidAmerican Response to Tech Customer DR 15e (Confidential)
- Guyer Exhibit 4 - Solar Resource;
- Guyer Exhibit 5 - National Blueprint for Lithium Batteries;
- Guyer Exhibit 6 - Global Status of CCS 2021;
- Guyer Exhibit 7 (confidential), Carbon Capture Update April 2021
- Guyer Exhibit 8 - CO2 Removal Cost at Louisa and Walter Scott 4;
- Guyer Exhibit 9 (confidential) – Louisa CO2 Capture Study;
- Guyer Exhibit 10 (confidential) – Walter Scott 4 CO2 Capture Study;
- Guyer Exhibit 11 (confidential) - Carbon Capture Update March 22; and
- Guyer Exhibit 12 (confidential) - Carbon Capture Opportunities Update April 13, 2021.

II. Assessment of Wind PRIME Using Hammer's Nine-Factor Analysis; A Summary of MidAmerican's Nine Factor Qualitative Analysis of the Benefits of Wind PRIME

Q: How did MidAmerican assess the benefits of the Wind PRIME proposal?

A: MidAmerican states that it primarily relies on its witness Mr. Hammer's "nine

factor" analysis to assess the reasonableness of the Wind PRIME additions. These criteria, which were created by MidAmerican, are (1) cost, (2) cost robustness, (3) environmental reasonableness, (4) system reliability, (5) economic development, (6) geopolitical uncertainty, (7) flexibility/optionality, (8) diversity, and (9) resource availability/stability. (Hammer Direct at 2, 28-45.)

Q: Do these nine factors support the reasonableness of the Wind PRIME proposal?

A: In my view, the record does not yet contain sufficient information to support approval of the Wind PRIME portfolio because MidAmerican has not compared the Wind PRIME projects to any other reasonable portfolios of resource additions as required by Iowa law. Even using Mr. Hammer's qualitative method, it is quite possible that an alternative set of resource additions – for example, a larger amount of solar combined with battery storage, as well as some amount of wind – would provide far greater benefits to customers.

a. COST

Q: Please summarize MidAmerican's analysis of the reasonableness of the Wind PRIME project costs.

A: Mr. Hammer states that the Wind PRIME project costs are supported by the economic analysis included in the testimony of MidAmerican Witness Specketer. (Hammer Direct at 32.) Environmental Intervenors Witness Glick addresses deficiencies with Mr. Specketer's analysis in her testimony. At a high level, MidAmerican's cost analysis does not look at whether a reasonable portfolio of alternative supply additions – for example, greater amounts of solar and storage

with some wind – would meet system needs at materially lower cost while better meeting other planning criteria.

b. COST ROBUSTNESS

Q: Please summarize Mr. Hammer's cost robustness analysis.

A: Mr. Hammer's cost robustness analysis is on pages 32 and 33 of his testimony. He observes that natural gas price volatility and the potential for policies that disincentivize carbon-emitting resources both weigh in favor of wind and solar generation in comparison to traditional thermal generation.

Q: Do you agree with this comparison?

A: Yes.

Q: Is Mr. Hammer's cost robustness analysis sufficient?

A: No. While wind and solar both avoid risks associated with fuel price volatility and the potential for future regulations on carbon-emitting sources, Mr. Hammer's cost robustness analysis does not explain why 2,042 MW of wind and 50 MW of solar is the reasonable amount of those resources to add, rather than, say, 2,000 MW of solar, 1,000 MW of storage, and some amount of wind. It is possible that an alternative portfolio of renewables that more heavily incorporates solar and storage would provide more value from a cost robustness perspective because it would better position the utility to meet future capacity needs. I will discuss this topic further below.

c. ENVIRONMENTAL REASONABLENESS

Q: What is an environmental impact?

A: Environmental impact means beneficial or adverse, direct or indirect, short term

or long term effects on ecology, natural resources, climate change, natural heritage, cultural heritage, lives, health, assets, livelihood, shelters and so on, that is caused by investment projects and activities.[1]

Q: Are wind, solar, and battery storage resources reasonable when considering the environmental impacts of other feasible sources of supply?

A: Yes. Unlike coal and gas fired generation, wind and solar resources provide the direct benefit of generating electricity without emitting sulfur dioxide, nitrogen oxides, greenhouse gasses, or other toxic air emissions such as mercury. Battery storage (as Mr. Hammer acknowledges in his testimony at 34-35) can enhance the value of solar and wind by charging during periods of high wind generation/low market prices and discharging during periods of lower supply.

Q: Will Wind PRIME provide other environmental benefits?

A: Yes. Wind PRIME will have an indirect benefit of reducing emissions of sulfur dioxide, nitrogen oxides, greenhouse gasses, and mercury as the generation from coal and gas fired generation decreases. As shown below and in Guyer Exhibit 1, MidAmerican forecasts Wind PRIME as resulting in a decrease in fossil fired generation, thereby reducing CO2 emissions. The amount by which MidAmerican expects Wind PRIME to impact its fleet's overall CO2 emissions depends on whether you look at MidAmerican's Reference Case, which includes a carbon adder that also (and at times more significantly) impacts the dispatch of its coal plants, or MidAmerican's Reference Case with no carbon adder.

Figure 1. MidAmerican's CO2 Emissions Forecast Under the Reference Case

[1] See "Environmental Impact definition," Law Insider, *available at* https://www.lawinsider.com/dictionary/environmental-impact.

(with Carbon Adder) (Guyer Direct Exhibit 1)

Figure 2 MidAmerican's CO2 Emissions Forecast Under the Reference Case (without Carbon Adder & low natural gas)

A decrease in fossil fired generation associated with Wind PRIME will also result

in proportional reductions in sulfur dioxide, nitrogen oxides, and mercury. The emission reductions associated with Wind PRIME will result in a direct benefit through improved air quality for Iowans, and reductions in greenhouse gas emissions necessary to address climate change.

Q: Are the environmental impacts of a project on climate change an important consideration?

A: Yes. Climate change is being driven by increasing atmospheric carbon dioxide concentrations mostly because of the fossil fuels that people are burning for energy. Fossil fuels like coal and oil contain carbon that plants pulled out of the atmosphere through photosynthesis over many millions of years; we are returning that carbon to the atmosphere in just a few hundred.[2]

Q: Does MidAmerican consider the environmental impact of a project on climate change?

A: Yes. MidAmerican witness McIvor testified that:

> "Climate change represents a major policy issue that will have future, potentially significant, implications for MidAmerican and every other generator of electricity. **MidAmerican follows these issues closely to determine the impact on its facilities and planning for future facilities**. MidAmerican supports the development of a responsible climate policy that addresses global climate change and reduces greenhouse gas emissions, while ensuring reasonably priced energy for consumers." (McIvor Direct at 20-21.)

McIvor notes that MidAmerican has committed to transitioning to net-zero Green House Gas (GHG) emissions, and uses a reduction in emission intensity to demonstrate progress towards net-zero. (McIvor Direct at 21.)

[2] "Climate Change: Atmospheric Carbon Dioxide," National Oceanic and Atmospheric Administration (June 23, 2022), *available at* https://www.climate.gov/news-features/understanding-climate/climate-change-atmospheric-carbon-dioxide (last visited July 27, 2022).

Q: Is emissions intensity (tons CO2/MWh) an appropriate way to evaluate progress towards a net-zero electricity system?

A: No. Net-zero means a reduction in carbon emissions, not just emissions intensity. MidAmerican can reduce its emissions intensity by adding wind without ever reducing fossil generation, while its total carbon emissions could remain stable.

Q: What does Net-Zero mean as defined by the Intergovernmental Panel on Climate Change (IPCC)?

A: The IPCC has clearly defined a goal of net zero by 2050. Net zero means that ***ALL global greenhouse gasses from all sources*** released into the atmosphere equals the amount of greenhouse gasses removed.

Q: Why is this Net Zero by 2050 Target Important?

A: To avoid the most severe climate change impacts, the IPCC has established the 2050 target in the effort keep global warming below 2˚ C and ideally below 1.5˚ C compared to pre-industrial levels. Climate impacts are already resulting in extreme weather in Iowa and jeopardizes grid stability. Utility decisions will directly affect future climate impacts.

Q: Has the IPCC Defined a Target for Electric Generation?

A: Yes. The IPCC issued *Climate Change 2022: Mitigation of Climate Change* in April of 2022.[3] The IPCC report makes clear that in order to limit warming to 1.5° C, **global electric generation from coal** will require a reduction of 82%

[3] "Climate Change 2022; Mitigation of Climate Change," Intergovernmental Panel on Climate Change Working Group III (2022), *available at* https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_FinalDraft_FullReport.pdf.

from 2020 levels by 2030.[4] Importantly, the IPCC report established that the delay or failure to achieve timely reductions in one sector increases the burden to decrease in other sectors.[5]

Q: Has the United States Committed to Achieve the IPCC Target?

A: Yes. The United States is a signatory to the Paris Agreement with a goal to keep global warming below 2˚ C and ideally below 1.5˚ C compared to pre-industrial levels. The Paris Agreement calls for countries to make their pledges to reduce emissions — called nationally determined contributions (NDCs) — more ambitious every five years. NDCs are at the heart of the Paris Agreement and the achievement of these long-term goals. NDCs embody efforts by each country to reduce national emissions and adapt to the impacts of climate change.

Q: What is the Current NDC for the United States?

A: On April 22, 2021, the United States set an **economy-wide target** of reducing its net greenhouse gas emissions by 50-52 percent below 2005 levels in 2030.[6] In addition to the economy wide target mentioned by MidAmerican witness McIvor, the NDC for the electricity sector is as follows:

> "In developing the NDC, the United States considered sector-by-sector emissions reduction pathways. Each policy considered for reducing emissions is also an opportunity to improve equity and support good jobs in the United States.
>
> The United States will decarbonize the energy sector, including by cutting energy waste; shifting to carbon pollution-free electricity; electrifying and

[4] *Id.* at 1061.
[5] *Id.*
[6] "The United States of America Nationally Determined Contribution Reducing Greenhouse Gases in the United States: A 2030 Emissions Target," United Nations Framework Convention on Climate Change, (2021), *available at* https://unfccc.int/sites/default/files/NDC/2022-06/United%20States%20NDC%20April%2021%202021%20Final.pdf.

> driving efficiency in vehicles, buildings, and parts of industry; and scaling up new energy sources and carriers such as carbon-free hydrogen. Actions to be pursued include, for example:
>
> **Electricity: The United States has set a goal to reach 100 percent carbon pollution-free electricity by 2035…"**[7]

The new NDC of a carbon free electricity sector by 2035, effectively eliminates electricity produced using coal and fossil gas after 2035.[8]

Q: Has MidAmerican pledged to address climate change?

A: Yes. MidAmerican via Berkshire Hathaway Energy was one of the signatories to the pledge on July 27, 2015, pledging to address climate change accelerating the transition to a low-carbon economy, recognizing the cost of delay in economic and human terms. MidAmerican witness Brown noted some of the companies that also signed climate pledges including Alcoa Corporation, Apple Inc., Bank of America Corporation, Cargill Inc., the Coca-Cola Company, General Motors Company, Goldman Sachs Group, Inc., Google LLC, Microsoft Corporation, PepsiCo, Inc., United Parcel Service, Inc. and Walmart Inc. The pledge made by MidAmerican and the other companies was as follows:[9]

> **THE AMERICAN BUSINESS ACT ON CLIMATE PLEDGE**
>
> *We applaud the growing number of countries that have already set ambitious targets for climate action. In this context, we support the conclusion of a climate change agreement in Paris that takes a strong*

[7] *Id.* at 12.
[8] "Fact Sheet: Biden Sets Greenhouse Gas Reduction Targets," (April 22, 2021), White House Briefing Room, *available at* https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/
[9] "FACT SHEET: White House Launches American Business Act on Climate Pledge," whitehouse.gov (July 27, 2015), *available at* https://obamawhitehouse.archives.gov/the-press-office/2015/07/27/fact-sheet-white-house-launches-american-business-act-climate-pledge.

> *step forward toward a low-carbon, sustainable future.*
> ***We recognize that delaying action on climate change will be costly in economic and human terms, while accelerating the transition to a low-carbon economy will produce multiple benefits with regard to sustainable economic growth, public health, resilience to natural disasters, and the health of the global environment.*** (Emphasis added)

The failure to plan in a comprehensive manner for a generation portfolio that is 100 percent carbon pollution-free electricity consistent with the NDC for electricity, risks *delaying action on climate change that will be costly in economic and human terms.*

Q: Do you believe that MidAmerican Destination Net Zero is consistent with the NDC?

A: No. The NDC calls for an accelerated timeline to have a carbon free electricity sector by 2035. MidAmerican Destination Net Zero is based on a timeline of 2050.

Q: Do you believe that MidAmerican is taking all appropriate actions to address climate change?

A: No. Although MidAmerican witness McIvor stated MidAmerican follows these issues closely to determine the impact on its facilities and planning for future facilities, MidAmerican provided testimony and exhibits showing that it does not intend to retire any of its existing coal plants [redacted], all of which are inconsistent with the current NDC or meeting a net-zero emissions

economy-wide by 2050 target.

Q: What actions should MidAmerican take to address environmental impacts from its generation?

A: Planning for future resources is critical and needs to be done in a manner that considers the long-term financial impact to MidAmerican customers. Ms. Glick describes in her testimony how resource expansion planning software can be used to ensure selection of a reasonable set of resource additions that meet customer needs. MidAmerican has recognized, as it should, that customers are demanding carbon free electricity. Meeting this need is critical from an economic development and prudence perspective.

Q: How have other utilities used resource planning software to develop resource addition mixes with an eye towards meeting carbon reduction commitments?

A: There are many examples, but a recent one includes Xcel Northern State Power's Minnesota plan. In that docket, Xcel proposed (among other things) to retire all of its coal by 2030 and add nearly 6,000 MW of renewables and 250 MW of battery storage,[10] and later agreed to issue an all-source RFP to solicit the potential to add more battery storage.[11] The RFP seeks 900 megawatts (MW) of solar or solar-plus-storage hybrid resources to come online by the end of 2025.[12] The Minnesota Public Utilities Commission ordered Xcel to add 1,320 megawatts (MW) of solar generation by 2026.[13] The Commission also approved the Company's need for

[10] *See* Xcel's June 25, 2021 Reply Comments in its 2020-2034 Upper Midwest Integrated Resource Planning docket No. E002/RP-19-368.
[11] See Xcel's July 20, 2022 filing, In the Matter of Xcel Energy's 2022 Solar and Solar-Plus-Storage Request for Proposals, RP-19-368 and new untitled docket.
[12] *Id.*
[13] *Id.* at 2.

approximately 600 MW of solar and 2,150 MW of wind, or an equivalent amount of energy and capacity from a combination of wind, solar and/or storage, between 2027 and 2032.[14] In developing this portfolio of additions, Xcel repeatedly examined how well the portfolio positioned it to meet its carbon reduction targets, citing both its own commitments and customer demand.[15]

d. ELECTRIC SUPPLY RELIABILITY

Q: **Please summarize Mr. Hammer's discussion of reliability.**

A: Mr. Hammer's reliability discussion is found on pages 35-38 of his direct testimony. When comparing generation technologies, Mr. Hammer lists the following system reliability considerations:

> "1. Availability at the time of system peak loads;
> 2. Availability for spinning and supplemental operating reserve;
> 3. Regulation (i.e., the ability of generation to follow changes in system requirements);
> 4. Response to MISO energy dispatch instructions, including those for curtailments;
> 5. Local area support (voltage support) – the reactive capability of a unit (i.e.,
> a generation technology's ability to produce or consume reactive demand);
> 6. Black start capability;
> 7.Transmission system improvements (e.g., the development or upgrade of transmission and/or reduction of impact on, or elimination of, a transmission constraint); and
> 8. Power quality – unit actively supports power quality."

(Hammer Direct at 36.) Mr. Hammer then describes some of the reliability strengths and weaknesses of various technologies.

[14] *Id.*
[15] See Xcel's June 25, 2021 Reply Comments in its 2020-2034 Upper Midwest Integrated Resource Planning docket No. E002/RP-19-368, at (for example) pages 5 (Fig 1-1), 10, 120 (Figure 4-8)

Q: Do you agree with the appropriateness of the eight reliability considerations listed by Mr. Hammer?

A: Yes, these are all relevant system adequacy considerations.

Q: Does Mr. Hammer explain why the Wind PRIME project was selected from a reliability perspective?

A: No. Mr. Hammer's testimony does not provide any explanation of why the Wind PRIME project is beneficial from a reliability perspective. He also does not explain why Wind PRIME would be more beneficial in terms of reliability than a reasonable alternative set of resource additions, such as solar, storage, and some wind.

Q: Would adding more solar and storage to MidAmerican's system provide reliability benefits?

A: I believe it is likely that, if MidAmerican were to quantitatively study adding more solar and storage to its system, it would find that additional solar and storage would provide reliability benefits.

As Mr. Hammer recognizes, solar can improve system reliability by contributing to meeting system peak. As noted by MidAmerican witness Hammer:

> "Utility scale solar resources that are dispatchable operate much like wind resources in that they are typically dispatched to their maximum capability and have the capability of being dispatched down to address operational needs. Solar generation is more likely than wind to be available at amounts near its maximum capability during the summer on-peak period and receives higher capacity credit eligibility, during that season, as a percentage of nameplate when compared to wind (about 40% to 50% of maximum capability but declining to about 35% or lower if solar penetration increases and with different capacity values across the seasons due to differences in seasonal solar insolation and the tight margin hours that will ultimately be considered by MISO for accreditation purposes)."

As a result, adding more solar would improve reliability by enhancing the Effective Load Carrying Capability (ELCC) of both wind and solar.

Q: Is there information on the complementary impact of wind and solar in MISO on ELCC?

A: Yes. The Midcontinent Independent System Operator (MISO) Renewable Integration Impact Assessment study concluded that:

> "Technology diversity also enhances the individual ELCC [Effective Load Carrying Capability] of both wind and solar. Three cases were run to isolate the impact of ELCC of each technology on the other: a wind-only system, a solar-only system, and a system with both wind and solar. *The results show that the two technologies have a mutually beneficial relationship* (Figure RA-5); *on average, the ELCC of wind and solar increases by 2 to 5 percentage points when the other technology is included in the system.*" [16] (Emphasis added.)

Q: What did the MISO RIIA study show regarding Loss of Load Probability (LOLP)?

A: The key finding was that the combination of wind and solar decreases the probability of not serving load during periods of high risk.[17]

> "Further analysis of the shifting risk profile shows that wind and solar have opposing effects on the shift in net-load peak and, therefore, on the risk profile (Figure RA-6). Since solar peaks during the middle of the day, and demand is higher in the evening than the morning, these resources tend to shift the net-load peak to later hours of days. As more solar is installed and, therefore, more solar energy is available later in the day, an increase in solar shifts the risky period to the evening hours. On the other hand, as wind ramps up in the evening and peaks at night, an increase in the wind capacity tends to move the risk profile to the left, earlier in the day. The opposing effect on the net-load peak means that wind and solar each move the net-load to periods in which the other resource can better serve load. As such, this push-pull effect is beneficial to the ELCC of the individual resource types; wind and solar are complementary."

[16] MISO's Renewable Integration Impact Assessment (RIIA), MISO (Feb. 2021), at 30, *available at* https://cdn.misoenergy.org/RIIA%20Summary%20Report520051.pdf.
[17] *Id.* at 31.

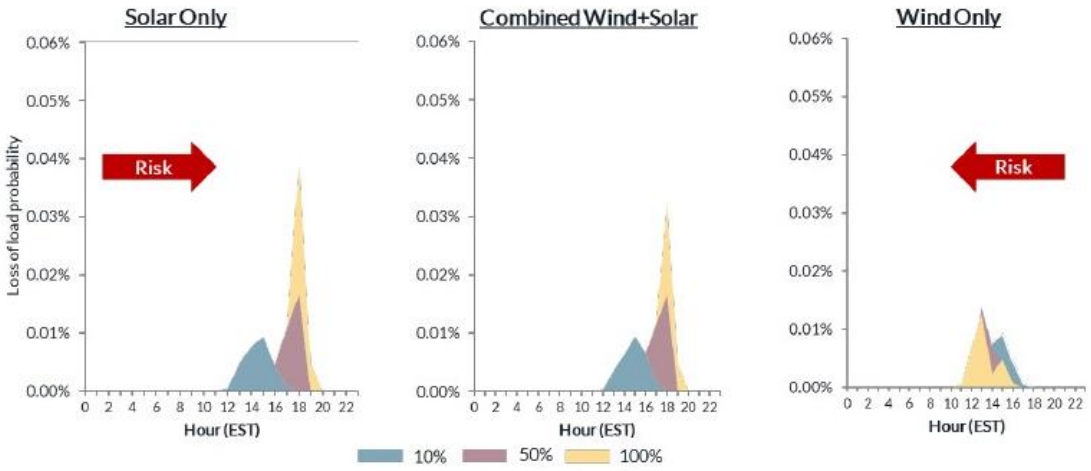


Figure RA-6: Change in LOLP by technology and milestone

Q: Does Mr. Hammer acknowledge the complementarity benefits of solar?

A: He does. He says:

> "Various power production technologies should complement one another to deliver electricity economically and reliably within a diverse resource portfolio while complying with environmental requirements and minimizing future risks. Therefore, any comparison of a power production technology with an alternative must be made in the context of the Company's existing assets and the broader energy and capacity markets."

(Hammer Direct at 30.) He also states:

> "Wind PRIME is MidAmerican's first advance ratemaking principles filing to include solar resources and it is noteworthy that the inclusion of solar further diversifies MidAmerican's fuel mix. Indeed, MISO's Renewable Integration Impact Assessment (RIIA) study concludes that wind and solar have complementary attributes. The RIIA report states "Finding: The combination of wind and solar decreases the probability of not serving load during periods of high risk."

(Hammer Direct at 25.) And finally, he states:

> "Wind PRIME includes an additional 50 MW of solar to capture solar's benefits from its provision of on peak energy to meet higher daily on peak load requirements, which complements MidAmerican's fleet of wind resources."

(Hammer Direct at 50.)

Q: **Given the reliability benefits of solar, does Mr. Hammer explain, from a reliability standpoint, why MidAmerican is not proposing more than 50 MW of solar?**

A: No, he does not.

Q: Does Mr. Hammer recognize that battery storage can provide system reliability benefits?

A: Yes. Mr. Hammer states that battery storage can assist with "balancing energy supply during periods of excess supply (storage charging) with periods when supply is lower (storage discharging)…." (Hammer Direct at 34-35.) He later continues that "Storage, including pumped storage hydroelectric, compressed air, and batteries, can respond quickly to provide capacity and energy to meet the reliability needs as described above." (*Id.* at 36-37.) He adds that: "The capability to discharge energy over an extended duration must be considered when considering the benefits of storage to system reliability and may limit its reliability value if the discharge capability is of short duration." (*Id.*)

Q: Given the reliability benefits of solar and storage, should MidAmerican have assessed whether an alternative portfolio of resource additions that included larger amounts of solar and storage and some amount of wind would have provided greater system reliability benefits?

A: Yes. As described in Ms. Glick's testimony, MidAmerican is creating a two-resource wind-coal system that may be overlooking the opportunity to strengthen system reliability by adding more solar and storage.

Q: How should MidAmerican assess the potential reliability benefits from

adding a larger amount of solar and storage?

A: Resource expansion planning modeling, as recommended by Ms. Glick, is designed to ensure resource adequacy – the long-term ability of the system resources to meet load in every hour. In other words, it is focused on ensuring cost-effective long-term reliability. If MidAmerican follows Ms. Glick's (and my) recommendation that the utility should use resource expansion modeling to analyze the wind PRIME portfolio in comparison to a modeling run that allows the model to select more solar and storage (and other clean resources, including wind, energy efficiency, and demand response), the modeling results will also provide useful information regarding the comparative reliability strengths of the two options.

e. FUEL DIVERSITY AND FLEXIBILITY/OPTIONALITY

Q: What does MidAmerican claim with regards to how Wind PRIME impacts its fuel diversity?

As shown in MidAmerican witness Hammer Table 2, MidAmerican argues that Wind PRIME increases both the installed capacity and accredited capacity of wind and solar in the MidAmerican generation portfolio, thereby decreasing reliance on fuel-dependent (that is, thermal and nuclear) generating plants.

Q: Do you agree with Witness Hammer's characterization of the diversity benefits of Wind PRIME?

A: While technically Wind PRIME increases installed capacity of wind and solar, fuel diversity requires looking at the broader context. As discussed in greater detail in Ms. Glick's testimony, there is a concern that, rather than improving

diversity and flexibility of MidAmerican's system, Wind PRIME may effectively lock in for decades a coal-wind system for MidAmerican. It is possible that the addition of far more solar and storage with some amount of wind would provide far greater diversity benefits: it would better diversify MidAmerican and MISO's resource mix (both of which currently have far more wind than solar or storage); and it could also improve MidAmerican's flexibility by better positioning the utility for the responsible phase out of its coal generating fleet.

Q: Does this mean you think Wind PRIME should be rejected?

A: Not at this point, and not necessarily. I think MidAmerican has not yet correctly analyzed whether Wind PRIME is a reasonable set of resource additions for its customers, and that it should analyze Wind PRIME using the quantitative modeling methodology described by Ms. Glick. It is possible that Wind PRIME is a reasonable set of resource additions for MidAmerican's customers. It is also possible that Wind PRIME should be modified to incorporate coal retirements (which would free up transmission, reduce congestion and thus improve locational marginal prices and corresponding revenues to other assets, including Wind PRIME itself), with consideration of whether far greater amounts of solar and storage and other clean energy resources in some combination would provide far greater benefit to customers.

Q: How does MidAmerican describe the flexibility/optionality benefits of the Wind PRIME additions?

A: As described in Mr. Hammer's testimony, MidAmerican appears to view flexibility/optionality as the ability to convert a generating unit to a different fuel

source, and that solar and wind are not as flexible because they have a fixed fuel source and cannot be used for other purposes. (Hammer Direct at 41-42.)

Q: Do you believe this is an appropriate way to evaluate resource flexibility/optionality?

A: No. Flexibility and optionality should include consideration of (1) how well a resource addition positions a utility to mitigate against potential risks (such as fuel price volatility and the potential for additional environmental compliance obligations at coal plants), and (2) how well the resource additions integrate with the existing system.

Q: What actions do you believe MidAmerican should be taking to further improve its generation diversity and flexibility/optionality?

A: MidAmerican should quantitatively evaluate whether the addition of more solar, storage, and increased conservation would improve its fuel diversity and flexibility/optionality. Increasing the amount of solar provides capacity benefits and energy benefits corresponding to peak summer usage. Whether solar has a future accredited capacity of 35% in MISO with an increased solar penetration as noted by MidAmerican witness Hammer, or the current accreditation value of 50% of nameplate, the addition of more solar might better address the capacity shortfalls projected in witness Hammer Table 3 starting in [redacted] than wind with an accreditation value of 16.3%, particularly when the solar is paired with battery storage.

Q: How should MidAmerican appropriately balance the generation resources in a cost-effective manner?

A: MidAmerican should use resource expansion modeling to perform resource expansion plan modeling to assess whether Wind PRIME represents a reasonable resource addition, and compare it to an alternative set of resource addition including more solar, storage, and some amount of wind.

Q: How have other utilities addressed the diversity and flexibility issues while maintaining reasonable costs?"

A: Utilities have used all-source requests for proposals (RFPs) to identify the available range of resources. As one example, PacifiCorp identified a significant amount solar and battery storage as economic, as shown by its 2020 All-Source Request for Proposals (RFP) final shortlist resources. These projects include 1,792 MW of wind, 1,150 MW of solar additions, and 639 MW of battery storage capacity—439 MW paired with solar and a 200 MW standalone battery. Over the 20-year planning horizon, the 2021 IRP Update preferred portfolio includes 4,160 MW of new wind and 5,297 MW of new solar co-located with storage.[18]

Q: Has modeling been performed that shows how MidAmerican could assess appropriately balancing its generation resources in a reliable and cost-effective manner?

A: Yes. A study was submitted in Docket No. SPU-2021-0003 by the Environmental Law and Policy Center, Iowa Environmental Council, and Sierra Club (Environmental Organizations) Exhibit 1, A Clean Energy Future for

[18] "2021 Integrated Resource Plan Update," PacifiCorp (Mar. 31, 2022), *available at* https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/energy/integrated-resource-plan/2021_IRP_Update.pdf.

MidAmerican and Iowa. Using the EnCompass capacity expansion model, the study found that retiring MidAmerican's coal fleet by 2030 and replacing it with 2000 MW of wind, 2060 MW of solar, 740 MW of battery storage, and energy efficiency would save MidAmerican ratepayers $1.2 billion to $5 billion over the next two decades. This study is discussed in more detail in Ms. Glick's testimony.

f. AVAILABILITY AND MATURITY

Q: Do you agree with the conclusions that MidAmerican witness Hammer made regarding availability and maturity that led to selecting primarily wind generation?

A: No. I will discuss each separately below.

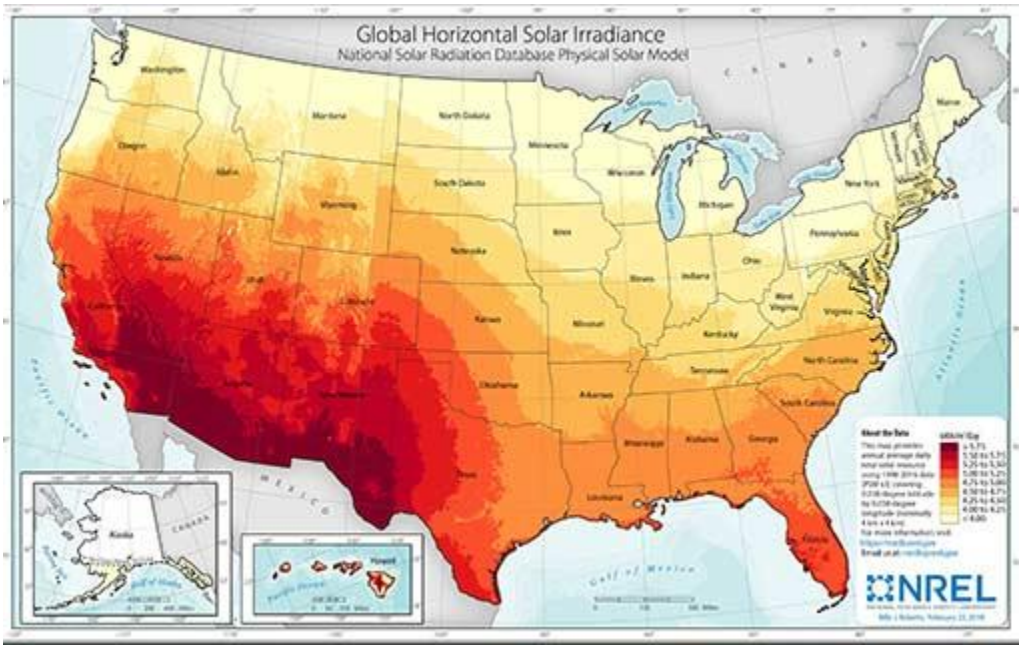
Q: What did Mr. Hammer conclude regarding availability?

A: MidAmerican witness Hammer uses the National Renewable Energy Laboratory ("NREL") report "Estimating Renewable Energy Economic Potential in the United States: Methodology and Initial Results," to show the technical potential for renewable generation in Iowa. The NREL report shows that Iowa has 16 times more solar capacity potential than wind, and seven times more solar energy potential than wind.

Q: **Do you agree with MidAmerican's conclusion that solar is less available in Iowa than wind?**

A: No. I agree with witness Hammer that solar in the Southwest enjoys better solar insolation. However, the solar resource available in Iowa is reflected in the NREL technical potential noted above, and a higher solar insolation value in the

Southwest is not a valid consideration when selecting resources for Iowa. In the same way, six states have better wind resources than Iowa, but wind can still be an appropriate resource selection for Iowa.[19] In fact, as shown in Guyer Direct Exhibit 4 and below, the solar resource in Iowa is similar to both Illinois and Indiana, and better than Michigan and Wisconsin, all where significant solar resources are being planned and are in the MISO queue.[20]



Mr. Hammer also dismisses solar because of the value of land for crop production. However, studies[21] have predicted that for Iowa to be 100% renewable would require as much as 46,000 MW of solar (approximately 1% of the technical potential). At 4 to 6 acres/MW, that would take less than 1% of the

[19] Anthony Lopez, et al., "U.S. Renewable Energy Technical Potentials: A GIS-Based Analysis," NREL (July 2012), *available at* https://www.nrel.gov/docs/fy12osti/51946.pdf.
[20] "GI Interactive Queue," MISO, *available at* https://www misoenergy.org/planning/generator-interconnection/GI_Queue/gi-interactive-queue/ (last accessed June 1, 2022).
[21] Nathaniel Baer, et al., "Iowa's Road to 100% Renewable," Iowa Environmental Council, *available at* https://www.iaenvironment.org/webres/File/IEC20002_PathwayTo100Renewable_F_Web.pdf (summarizing renewable energy studies).

state's 30,500,000 acres of farmland.[22] Additionally, solar represents an attractive value proposition for farmers looking to diversify their income by leasing a portion of their land. Farmers, who are free to determine the best use of their land, have been willing to lease it for solar developments.

Q: What did Mr. Hammer conclude regarding the economics of solar and wind?

A: MidAmerican witness Hammer provides information from a February 8, 2021 report developed by the Energy Information Administration ("EIA") providing estimates of the levelized cost of electricity ("LCOE"). (Hammer Table 6 at 56.) The EIA data shows that solar has the lowest LCOE for both the simple average and the capacity weighted average. Hammer also notes the MISO queue stating that: "There continue to be a significant number of wind interconnections requests in the MISO queue, and solar interconnection requests are also on the rise." (Hammer Direct at 53.)

Q: Do you agree with Mr. Hammer's conclusion that more wind than solar is available in the MISO queue?

A: No. The MISO queue on June 1, 2022, showed the following active projects under study:

Active Reviews	Solar (MW)	Wind (MW)
Iowa	2,691	2,483
Indiana	14,039	1,200
Illinois	7,600	3,379

[22] "2021 State Agriculture Overview," U.S. Department of Agriculture National Agricultural Statistics Service, *available at* https://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=IOWA.

Michigan	10,414	1,123
Minnesota	3,284	1,713
Missouri	3,286	400
Wisconsin	8,164	1,058
Total	75,770	14,212

The MISO queue on June 1, 2022 showed projects with studies completed:

Reviews Done	Solar (MW)	Wind (MW)
Iowa	915	11,493
Indiana	2,191	2,231
Illinois	2,467	4,201
Michigan	1,584	3,917
Minnesota	776	5,848
Missouri	1,914	1,456
Wisconsin	2,957	2,630
Total	19,802	35,893

When looking solely at LCOE and the MISO queue, since solar has a lower LCOE and a clear predominance in the MISO queue, solar is superior to wind.

Q: What did Mr. Hammer conclude about resource maturity?

A: MidAmerican witness Hammer states that "A technology achieves maturity as its development moves from the research phase to wider acceptance and a competitive industry develops for supply of the equipment related to that

technology." (Hammer Direct at 51.) Hammer then states that solar generation is also becoming competitive to imply that solar technology is not mature. He provides solar with one less "star" compared to wind when scoring maturity.

Q: Do you agree with Mr. Hammer's analysis of solar's maturity?

A: No. Based on the definition provided by Hammer, solar is clearly a mature technology as demonstrated by data from the Solar Energy Industry Association (SEIA)[23]:

> Solar has ranked first or second in new electric capacity additions in each of the last 9 years. In 2021, 46% of all new electric capacity added to the grid came from solar, the largest such share in history and the third year in a row that solar added the most generating capacity to the grid. Solar's increasing competitiveness against other technologies has allowed it to quickly increase its share of total U.S. electrical generation - from just 0.1% in 2010 to nearly 4% today.

Based on SEIA data,[24] the current MW of solar in the following MISO states is as follows:

IA	IL	IN	MI	MN	MO	WS
447	1107	1619	759	1678	352	837

To suggest that solar is not a mature technology is disingenuous. Clearly, MidAmerican must have viewed solar a mature technology when it purchased the 100 MW Holliday Creek solar farm.

Q: What about the maturity and availability of utility-scale storage?

A: Contrary to suggestions and conclusory statements by MidAmerican that utility scale battery storage needs additional study, lithium-ion batteries first became

[23] Solar Energy Industries Association, Solar Industry Research Data, *available at* www.seia.org/solar-industry-research-data (last visited July 25, 2022).
[24] Solar Energy Industries Association, Solar State by State *available at* www.seia.org/states-map (last visited July 25, 2022).

commercially available in 1991, and the U.S. Energy Information Administration (EIA) has tracked the capacity of utility scale battery storage since 2003.[25] With almost 20 years of utility battery storage operation and growth, it is clear that utility battery storage is a commercially available mature technology. Guyer Direct Exhibit 5 notes that "Lithium-ion batteries are *pervasive* in our society. Current and projected demand is dominated by electric vehicles (EVs), but lithium-ion batteries also are *ubiquitous* in consumer electronics, critical defense applications, and in *stationary storage for the electric grid*"[26] (emphasis added).

Q: Are other utilities in MISO moving forward with plans for battery storage?

A: Yes. The Board recently approved a certificate of public convenience and necessity authorizing 75 MW of storage. Docket No. GCU-2021-0003, "Order Granting Request for Waivers and Application for a Certificate of Public Convenience, Use and Necessity Under Iowa Code Chapter 476A" (filed July 26, 2022). The previously mentioned Xcel Energy Integrated Resource Plan approved on February 2, 2022, by the Minnesota Public Utilities Commission includes 250 MW of energy storage.[27] The 2021 Duke Indiana IRP calls for the addition of 400 MW of storage paired with solar.[28] WEC Energy Group and Madison Gas

[25] U.S. Energy Information Administration, *U.S. utility-scale battery storage power capacity to substantially by 2023* (July 10, 2019) *available at* www.eia.gov/todayinenergy/detail.php?id=40072 (last visited March 24, 2022).
[26] Federal Consortium for Advanced Batteries, *National Blueprint for Lithium Batteries 2021-2030*, at 10 (June 2021) *available at* www.energy.gov/sites/default/files/2021-06/FCAB%20National%20Blueprint%20Lithium%20Batteries%200621_0.pdf (last visited March 24, 2022).
[27] "Upper Midwest Energy Plan," Xcel Energy (2021), *available at* https://www.xcelenergy.com/staticfiles/xe-responsive/Company/Rates%20&%20Regulations/Resource%20Plans/Upper%20Midwest%20Energy%20Plan%20-%202021.pdf.
[28] "2021 Duke Energy Integrated Resource Plan, Volume 1," Duke Energy (Dec. 15, 2021), *available at* https://www.in.gov/iurc/files/public-duke-energy-indiana-2021-irp-volume-i.pdf.

and Electric have announced the plan to purchase two solar plus storage projects from Invenergy with a combined 185 MW of battery storage.[29] PacifiCorp's 2021 resource plan includes 6,181 megawatts of storage resources, including battery storage co-located with solar, standalone battery storage and pumped hydro storage resources. The plan calls for adding nearly 700 MW of battery storage by the end of 2024. Through 2040, the 2021 IRP includes 4,781 MW of storage co-located with solar resources, 1,400 MW of standalone battery and 500 MW of pumped hydro.[30] NextEra – the largest wind generator in the U.S., ahead of MidAmerican – announced last month that it plans to add thousands of megawatts of storage to Florida Power & Light's system, in addition to the utility's existing 500 MW of storage.[31] While long-duration battery storage is in a more nascent phase, Great River Energy is also pursuing a 1-MW long-duration storage pilot with Form Energy.[32]

Q: Is the current battery capacity in MISO, or any Regional Transmission Organization / Independent System Operator (RTO/ISO), evidence that the battery storage technology is not mature?

[29] Andy Colthorpe, "Wisconsin utilities plan 250MW solar project with 75MW of battery storage," Energy Storage News (Mar. 23, 2021), *available at* https://www.energy-storage.news/wisconsin-utilities-plan-250mw-solar-project-with-75mw-of-battery-storage/.
[30] "Storage," PacifiCorp, *available at* https://www.pacificorp.com/energy/storage.html (last visited July 27, 2022).
[31] "NextEra Energy sets industry-leading Real Zero™ goal to eliminate carbon emissions from its operations, leverage low-cost renewables to drive energy affordability for customers," NextEra Energy (June 14, 2022), *available at* https://newsroom nexteraenergy.com/2022-06-14-NextEra-Energy-sets-industry-leading-Real-Zero-TM-goal-to-eliminate-carbon-emissions-from-its-operations,-leverage-low-cost-renewables-to-drive-energy-affordability-for-customers.
[32] "Form Energy Announces Pilot with Great River Energy to Enable the Utility's Transition to an Affordable, Reliable and Renewable Electricity Grid," Form Energy, *available at* https://formenergy.com/wp-content/uploads/2020/05/Form-Energy_-GREPilotPress-Release.pdf.

A: No. The adoption rate of battery storage in MISO, or any RTO/ISO, is a reflection of two factors unrelated to technology maturity. The first factor is battery storage costs, which have only recently made batteries cost-effective resources. Lithium-ion battery pack prices fell 89% from above $1,100/kWh in 2010 to $137/kWh in 2020.[33] The significant reduction in the price of battery storage means that it is now a more economic resource and that barrier to deployment is much smaller.

The second factor has been the timing for MISO to address how to treat storage resources. MISO first filed a comprehensive tariff with the Federal Energy Regulatory Commission (FERC) to comply with FERC Order 841 on December 3, 2018, enabling Electric Storage Resource participation in MISO's capacity, energy and ancillary services markets. The tariff allowed Electric Storage Resources to participate in MISO's Energy and Operating Reserve Markets as supply and demand, set market clearing prices as either supply or demand, and provide energy and ancillary service products through a customized offer structure that incorporates Order 841's required parameters.[34]

As noted by the EIA in *U.S. utility-scale battery storage power capacity to grow substantially by 2023* (July 10, 2019):

> "Growth in utility-scale battery installations is the result of supportive state-level energy storage policies and the Federal Energy Regulatory Commission's Order 841 that directs power system operators to allow

[33] America Clean Power website, Clean energy storage facts, *available at* cleanpower.org/facts/clean-energy-storage/ (last visited July 27, 2022).
[34] "RTO files tariff changes to establish Electric Storage Model," MISO (Dec. 4, 2018), *available at* https://www.misoenergy.org/about/media-center/miso-moves-forward-to-further-integrate-energy-storage-resources/ (last visited July 27, 2022).

> utility-scale battery systems to engage in their wholesale energy, capacity, and ancillary services markets. In addition, pairing utility-scale battery storage with intermittent renewable resources, such as wind and solar, has become increasingly competitive compared with traditional generation options."[35]

Q: Do you believe MidAmerican should include battery storage to further diversify the generation portfolio?

A: Yes. If MidAmerican had used resource capacity expansion modeling such as Aurora or EnCompass to optimize the generation fleet, it would have likely included currently available and proven battery energy storage.

Q: What other feasible sources of supply should MidAmerican consider?

A: Consistent with the application requirements in Iowa Administrative Code section 199 IAC 41.3(4)"d," MidAmerican should also evaluate conservation as a supply source. As a part of Wind PRIME, MidAmerican witness Hammer did not consider or discuss conservation in his testimony addressing that section of code in his nine-factor analysis.

III. Addressing Customer Renewable Energy Goals

Q: Does Wind PRIME help customers meet their renewable energy goals?

A: Partially. MidAmerican witness Brown describes the MidAmerican 100% renewable energy vision:

> "Wind PRIME completes MidAmerican's 100% renewable energy vision…. Once Wind PRIME is completed, MidAmerican will have over 9,300 MW of wind generation and nearly 200 MW of solar generation and will be projected to serve 111% of its customers' annual energy needs with renewable generation in 2025."

[35] U.S. Energy Information Administration, *U.S. utility-scale battery storage power capacity to grow substantially by 2023* (July 10, 2019) *available at* www.eia.gov/todayinenergy/detail.php?id=40072 (last visited July 25 2022).

(Brown Direct at 11.) Meeting this vision will satisfy the renewable energy goals of customers with goals based on renewable energy credits. MidAmerican uses the GreenAdvantage® program to verify the annual percentage of renewable generation as a percentage of the retail electric load, consistent with how MidAmerican has defined its vision of 100% renewable energy.

Q: What type of customer renewable energy goals are not met by Wind PRIME?

A: As laudable as the MidAmerican vision sounds, MidAmerican's proposal does not meet customers' demands for 100% carbon-free electricity around the clock because it continues to rely heavily on MidAmerican's coal generation.

Q: Which MidAmerican customers have goals that would not be fully satisfied by Wind PRIME?

A: The following is a list of the renewable energy goals of some MidAmerican customers that have signaled demand for 100% around the clock (that is, in every hour) carbon-free electricity.

- Google – "we intend to run on 24/7 carbon-free energy (CFE) – everywhere, at all times. And we aim to do it by 2030."[36]
- Apple – "While Apple is already carbon neutral across its global operations, by 2030, every Apple device sold will have a net-zero climate impact. 'Every company should be a part of the fight against climate change, and together with our suppliers and local communities,

[36] "24/7 Carbon-free Energy by 2030," Google, *available at* https://www.google.com/about/datacenters/cleanenergy/ (last visited July 27, 2022).

we're demonstrating all of the opportunity and equity green innovation can bring,' said Tim Cook, Apple's CEO. 'We're acting with urgency, and we're acting together. But time is not a renewable resource, and we must act quickly to invest in a greener and more equitable future.'"[37]

- Microsoft - Microsoft has announced that by 2030 the company will have 100% of its electricity consumption, 100% of the time, matched by zero carbon energy purchases. The move extends Microsoft's existing commitment to execute power purchase agreements equivalent to 100% of its energy needs by 2025.[38]

- Des Moines – "BE IT FURTHER RESOLVED that the City hereby commits to a community-wide goal of achieving 100% 24x7 electricity from carbon-free sources by 2035."[39]

- Waterloo – "BE IT RESOLVED… that the City hereby commits to an affordable and reliable community-wide goal of achieving 100% 24x7 electricity from carbon-free sources by 2035."[40]

[37] "Apple charges forward to 2030 carbon neutral goal, adding 9 gigawatts of clean power and doubling supplier commitments," Apple (Oct. 27, 2021), *available at* https://www.apple.com/newsroom/2021/10/apple-charges-forward-to-2030-carbon-neutral-goal-adding-9-gigawatts-of-clean-power-and-doubling-supplier-commitments/ (last visited July 27, 2022).
[38] Harun Asad, "Microsoft Announces New 100/100/0 Commitment By 2030," Environment + Energy Leader (July 14, 2021), *available at* https://www.environmentalleader.com/2021/07/microsoft-announces-new-100-100-0-commitment-by-2030/ (last visited July 27, 2022).
[39] "Establishing New Greenhouse Gas Emissions Reduction Goals and a Community 24x7 Carbon-Free Electricity Goal for the City of Des Moines," City of Des Moines, Jan. 11, 2021, available at https://councildocs.dsm.city/Resolutions/20210111/32.pdf.
[40] "Resolution Establishing a Community 24x7 Carbon-Free Electricity Goal for the City of Waterloo," City of Waterloo (July 18, 2022), *available at* https://waterloo novusagenda.com/agendapublic/AttachmentViewer.ashx?AttachmentID=34186&ItemID=23928.

These examples show that MidAmerican customers, and cities served, want 100% carbon-free electricity in every hour – not just the equivalent of their annual load. MidAmerican's 100% renewable energy vision will not provide customers with the 24/7 100% carbon-free electricity being called for by customers because MidAmerican's plan relies on continued indefinite operation of its coal plants.

Q: Do customers with a 24/7 100% carbon free electricity goal or the equivalent represent a significant portion of MidAmerican customer sales?

A: Yes. The tech customers represent 16% of MidAmerican retail sales,[41] Des Moines represents 16% of customer sales, and Waterloo represents 5% of customer sales, for a total of 37% of customer sales.[42] I expect the number of customers and communities with 24/7 100% clean electricity goals to grow in the coming months and years.

IV. Technology Study

Q: What has MidAmerican proposed related to the study of various technologies not included in Wind PRIME?

A: MidAmerican proposes to spend $25 million to study carbon capture on Louisa and Walter Scott unit 4, modular nuclear, and battery storage technologies. The proposal is described in Mr. Fehr's testimony at pages 26-29, and the rate making principle in Mr. Specketer's testimony at 16-17.

Q: How does the technology study cost rate making principle allocate risk?

A: If the studies are successful, the costs will be incorporated into a future advanced

[41] 2021 Berkshire Hathaway Energy Form 10K, page 12, available at https://www.brkenergy.com/assets/upload/financial-filing/20211231_MEC%20Form%2010-K.pdf.
[42] Des Moines and Waterloo retail customer sales estimates based on population.

rate making docket. If the studies are unsuccessful, customers would pay the costs through a future rate case. This rate making principle is the equivalent of gambling customer money where the only winner is the MidAmerican house, and does not meet the requirements of the advanced ratemaking principle law. I will address why each should not be approved.

Q: How does MidAmerican describe the carbon capture and storage study?

A: MidAmerican witness Fehr provides a brief statement of intent to study carbon capture and storage:

> "Carbon capture and storage is a technology that can be retrofitted into existing fossil generation facilities to capture carbon dioxide emissions before they are released to the atmosphere. The captured carbon dioxide is then delivered through a pipeline to an underground repository for storage. MidAmerican proposes to study the use of this technology at the Walter Scott Energy Center, Unit No. 4 and Louisa Generating Station. The technology is currently capable of capturing approximately 90% of all carbon dioxide generated by the coal combustion process."

(Fehr Direct at 28.) However, Witness Fehr provides nothing to support the use or status of the technology, and refers to pipelines that do not yet exist.

Q: At the outset, why is using customer dollars to study CCS a risky proposition?

A: The first major concern with using customer funds to study carbon capture on MidAmerican's coal plants is that it is extremely financially risky. Guyer Direct Exhibit 6 assesses the use of CCS at coal plants. The Global CCS Institute issued the report,[43] and identifies only two coal fired power plants, Boundary Dam and

[43] "Global Status of CCS 2021," Global CCS Institute (2021), *available at* https://www.globalccsinstitute.com/wp-content/uploads/2021/10/2021-Global-Status-of-CCS-Global-CCS-Institute-Oct-21.pdf.

Petra Nova, with carbon capture and storage. Petra Nova has suspended operations of the carbon capture and storage.[44]

Q: Has MidAmerican demonstrated that it is reasonable to study CCS at Louisa and Walter Scott 4?

A: No. MidAmerican has not shown that Louisa and Walter Scott 4 are currently economic sources of generation, let alone that they will continue to be economic with the additional costs to construct and operate CCS. As I will explain below, adding carbon capture technology to these plants will require a massive capital expenditure at the plants and will also dramatically increase their operating costs. Before going down this road, MidAmerican should have assessed whether Louisa and Walter Scott 4 continue to represent reasonable and cost-effective generating assets to its system. MidAmerican should conduct this analysis using the resource capacity expansion modeling that I have discussed above. The Board should not consider approving the $25 million Technology Study principle without first seeing this analysis.

Even if MidAmerican had done the analysis to show that Louisa and Walter Scott 4 are currently economic resources, it would then need to analyze – again using resource expansion planning software – whether a resource mix including Louisa with CCS and Walter Scott 4 with CCS is reasonably cost effective compared to reasonable alternative sets of resource additions.

[44] "Petra Nova status update," NRG Energy, Inc. (Aug. 26, 2020), available at https://www.nrg.com/about/newsroom/2020/petra-nova-status-update html (last visited July 27, 2022).

It is unlikely that coal retrofitted with CCS will perform favorably compared to a portfolio of solar, storage, and wind additions. This is because adding CCS to existing coal plants requires a substantial (and uncertain) upfront capital cost and then has significant operating costs.

According to an internal MidAmerican presentation, the company estimates it would cost [redacted] to install carbon capture at WSEC 4 and [redacted] at Louisa. (Guyer Direct Exhibit 7.) Even assuming MidAmerican can achieve a 90% capture rate, the operation of carbon capture and storage at a coal plant has two major drawbacks: a significant energy penalty and significant increases to the cost of operation.

There is a significant energy cost involved. For new power plants, this is quoted as 20-25% of plant output, due both to reduced plant efficiency and the energy requirements of the actual process.[45] The International Energy Agency (IEA) has indicated the cost to remove every ton of CO2 at a 90% removal efficiency to be $65 per metric ton.[46] In Guyer Direct Exhibit 8, I used a $65 per metric ton removal cost to calculate the cost per MWh to remove CO2 at 90% removal efficiency. Based on the 2021 emissions data for Louisa and Walter Scott 4,[47] this removal cost would add approximately $57 and $58 per MWh respectively to the cost of generation, even before considering the energy penalty or the cost to

[45] "Clean Coal Technologies," World Nuclear Association (Nov. 2021), *available at* https://world-nuclear.org/information-library/energy-and-the-environment/clean-coal-technologies.aspx (last visited July 27, 2022).
[46] "CCUS technology innovation," International Energy Agency, available at https://www.iea.org/reports/ccus-in-clean-energy-transitions/ccus-technology-innovation (last visited July 27, 2022).
[47] "Clean Air Markets Program Data," U.S. EPA, available at https://campd.epa.gov/.

transport and store the CO2.

MidAmerican provided a price forecast that includes a carbon dispatch adder to fossil fuel production costs starting in 2026 and escalating annually thereafter as shown in MidAmerican Hammer Direct Exhibit 3 – Confidential: Price Forecasts. [redacted]

Q: Do MidAmerican's previous studies of carbon capture and storage at Louisa and Walter Scott 4 support your assertion that these projects are likely not in customers' interests?

A: Yes. In response to Environmental Intervenor Data Request 8, MidAmerican provided studies conducted by Sargent & Lundy on its behalf. The studies are being submitted as Guyer Direct Exhibit 9 and Guyer Direct Exhibit 10. These studies [redacted]. [redacted] Relying on these purely speculative revenue streams to justify further exploration of these projects using ratepayer dollars is not appropriate.

Q: Do MidAmerican's internal presentations support your assessment that

installment of CCS at Walter Scott 4 and Louisa will make them even more economically uncompetitive?

A: Yes. In presentations provided by MidAmerican in discovery, attached as Guyer Direct Exhibit 11, MidAmerican says:

> "[redacted]." *Id.* at 8.

And in Guyer Direct Exhibit 12, MidAmerican also notes that the [redacted]

Q: Have any other states' utility regulators approved a similar proposal to recover CCS investigatory study costs from ratepayers?

A: Not to my knowledge.

Q: What does MidAmerican say about studying small modular reactor technology?

A: MidAmerican witness Fehr provides a brief statement of intent to study small modular reactor technology:

> "Small modular reactors hold promise for carbon-free baseload generation that strengthens reliability and efficiently integrates into energy markets with a high penetration of intermittent generators (e.g., wind and solar), but the reactors also lack construction and operating experience and, therefore, require extensive additional study to better understand what role they may have in MidAmerican's future generation fleet."

(Fehr at 29-30.) However, Witness Fehr provides nothing to support how a

technology study removes the uncertainties associated with construction and operating experience.

Q: Why is studying small modular reactor technology a poor use of customer funds?

A: The very uncertainties that witness Fehr briefly discusses of construction and operational experience will become apparent by 2028 as Berkshire Hathaway Energy subsidiary Rocky Mountain Power takes over ownership and operation of the TerraPower project at the Naughton plant. The project is being financed by $1.9 billion from the U.S. Department of Energy's Advanced Reactor Demonstration Program—which requires the demonstration project to be operational by 2028—and Microsoft founder Bill Gates.[48] Specifically:

> The demonstration plant is intended to *validate the design, construction and operational features of the Natrium technology*, TerraPower said in a statement. The project features a 345-MW sodium-cooled fast reactor with a molten salt-based energy storage system. The storage technology can boost the system's output to 500 MW when needed…. *The energy storage capability allows the plant to integrate with renewable resources*. (emphasis added)

I do not believe MidAmerican provided sufficient justification for studying small modular nuclear reactors at this time given that TerraPower either will have been demonstrated to be successful, or not, by 2028.

Q: How does MidAmerican justify its proposal to also study battery storage?

A: MidAmerican witness Fehr lists several types of technologies that can provide a

[48] "TerraPower selects Kemmerer, Wyoming as the preferred site for advanced reactor demonstration plant," TerraPower (Nov. 16, 2021), available at https://www.terrapower.com/natrium-demo-kemmerer-wyoming/.

storage function, but then concludes additional study is necessary because a sufficient amount of battery storage has not yet been installed in MISO. (Fehr at 28-29).

Q: Is the current battery capacity in MISO, or any Regional Transmission Organization/ Independent System Operator (RTO/ISO), a justification for using customer funds to study storage?

A: No. Unlike modular nuclear and CCS, utility-scale battery storage is a proven and mature technology that many other utilities have identified as a cost-competitive resource addition, and is actively being adopted by other utilities in MISO, including the Interstate Power and Light proposal for 75 MW of storage.[49]

Q: Do you oppose the technology study principle for battery storage for the same reasons you oppose the studies of CCS and nuclear?

A: No; actually, I oppose it for the opposite reason. MidAmerican has not shown why ratepayers, rather than shareholders, should bear the high risks associated with its exploration of modular nuclear and CCS. In contrast, many utilities and studies show that battery storage is cost-competitive now and are rapidly committing to its adoption. This is especially true for utilities with high amounts of renewables on their systems, like MidAmerican. MidAmerican should (1) conduct the kind of analysis recommended by Ms. Glick to assess whether a portfolio with significant amounts of battery storage should be added to MidAmerican's system, and (2) issue a technology-neutral RFP, with Board

[49] "Duane Arnold Solar Project," Alliant Energy, available at https://www.alliantenergy.com/cleanenergy/ourenergyvision/solargeneration/iowasolar/duanearnoldsolar (last visited July 27, 2022).

oversight, to assess the ability of the market to provide solar and storage at competitive prices.

V. Conclusion

Q: Do you support the MidAmerican Wind Prime proposal to add 2042 MW of Wind, 50 MW of solar, and the Technology Study Rate Making Principle?

A: For the reasons discussed, I do not believe that MidAmerican has yet demonstrated the reasonableness of adding 2042 MW of wind generation and 50 MW of solar generation, particularly since MidAmerican has not demonstrated that it has adequately considered other sources for long-term electric supply such as solar, storage, and energy efficiency. MidAmerican should supplement the record with resource expansion planning modeling to properly assess the potential system benefits of Wind PRIME, and should also analyze whether a portfolio of larger amounts of solar and storage plus some amount of wind, in combination with allowing any uneconomic coal plants to retire, would better meet all of the criteria discussed above. For the reasons discussed above, I do not support the technology study rate making principle sought by MidAmerican Energy Company (MEC) in this Advance Ratemaking Principles docket.

Q: Does this conclude your testimony?

A: Yes.

AFFADAVIT OF STEVEN C. GUYER

STATE OF ILLINOIS) ss.
COUNTY OF)
COOK

I, Steven C. Guyer, being first duly sworn on oath, state that I am the same Steven C. Guyer 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/ Steven C. Guyer
Steven C. Guyer

State of Illinois County of Cook
Subscribed and sworn before me the 29th day of July, 2022.

/s/ Elizabeth Prakel
Notary Public in and for the
State of Illinois