MidAmerican Resource Evaluation Study
IEC, ELPC and Sierra Club
November 22, 2024

RE: Environmental Intervenors' Comments on MidAmerican's Fourth Resource Evaluation Study (RES) Meeting

Environmental Intervenors (EI) thank MidAmerican Energy Company ("MidAmerican") for the opportunity to provide comments on the fourth Resource Evaluation Study (RES) meeting held on October 29, 2024. At this meeting, MidAmerican presented results from its Aurora modeling, with a focus on the Company's Preferred Portfolio, and the scoring metrics that it used to evaluate its portfolios. The Company also presented information on its approach to risk and resource adequacy.

The following comments provide our responses to the limited materials presented at the fourth RES meeting. The EI will provide comprehensive feedback on all of MidAmerican's RES modeling as well as the full RES process in subsequent comments on MidAmerican's filed RES.

We are pleased to see that solar PV appears as a cost-effective near-term resource option in nearly all the Company's portfolios, as this aligns with our own preliminary findings from our independent modeling. But we are concerned that in the final stage of the RES process, MidAmerican is taking actions that run counter to IRP best practices for transparently developing a least-cost portfolio. Specifically, MidAmerican developed its Preferred Portfolio outside the Aurora model, and designed a scorecard that provides somewhat arbitrary rankings.

We encourage MidAmerican to take steps to timely procure the near-term solar shown to be cost-effective across a range of the Company's portfolios. We also recommend that the Company remove the unsupported resources from its Preferred Portfolio, and update its use of portfolio scoring metrics to a framework that allows for a fair or meaningful comparison of portfolios.

I. MidAmerican finds that near-term deployment of solar PV is part of a least-cost portfolio.

The EI support MidAmerican's findings that procurement of 750 MW of solar PV as part of a near-term action plan is cost-effective. This finding by MidAmerican is consistent with the results of our independent modeling and analysis which also found near-term deployment of solar PV is part of a cost-effective resource plan for MidAmerican. Our main concern is that MidAmerican's modeling inputs constrain the model and prevent it from selecting even more cost-effective solar resources. MidAmerican limits solar additions in the modeling to 300 MW per year—and the model reaches this limit in 2025 and 2026.[1] This result indicates that the Aurora model likely would have selected even more solar as a least-cost resource in those years if it were not constrained to 300 MW. Additionally, even while allowing the model to select solar PV in the near term, MidAmerican has expressed skepticism that it can feasibly bring online new solar PV before 2028.[2] While there may be feasible limits, MidAmerican can still approach procurement based on the economic results from its modeling, and let the market decide what is feasible and available. When taking into account its view of feasible limits, MidAmerican plans for the addition of 250 MW of solar PV in 2028 and 500 MW in 2029—which exceeds the annual limit of 300 MW that it modeled.[3] MidAmerican has claimed during discussion at Meeting 3 and Meeting 4 that there is an immediate generation need. Solar is a resource that can meet the generation need, and there is no reason to artificially constrain how much economic solar MidAmerican pursues.

Recommendation:

Given that the Company's analysis has shown that near-term solar is part of a least-cost plan, MidAmerican's should be taking steps to timely procure as much solar as it can. MidAmerican should not limit its search to solar achieving commercial operation after 2028. The Company should specify that it is looking for solar resources as soon as possible and let the market decide what level of solar is cost-effectively available.

II. Preferred Portfolio

Best practices in resource planning require that utilities use an industry-standard capacity-expansion and production cost model to evaluate potential resource options and identify a least-cost resource portfolio to serve customers. MidAmerican did utilize capacity expansion modeling to develop and study a variety of portfolios. However, MidAmerican ultimately created its Preferred Portfolio by hand-selecting 500 MW of small modular nuclear reactors (SMR) plus salt storage and manually adding these resources to a portfolio in 2036. This resulted in a portfolio that was not least cost.

After conducting months of modeling in Aurora, it's concerning that MidAmerican ultimately chose to hard code in SMRs + salt storage at the end of the process. It is inconsistent with best practices in modeling for the Company to pick a winner rather than relying on economic modeling results. It's also unclear how MidAmerican created this Preferred Portfolio— specifically, how it developed the base portfolio to which it added SMRs + salt storage. The SMR with Salt Storage Sensitivity has nearly 200 MW less solar PV in 2026, and 219 MW less new CT capacity and 288

[1] MEC Meeting 4 Presentation, at 44.
[2] MEC Meeting 4 Presentation, at 44.
[3] MEC Meeting 4 Presentation, at 44.

more solar PV capacity in 2033 than the Reference Portfolio. While the 2033 differences can more easily be linked to the change in resource additions in 2036, it's unclear how the addition of SMR in 2036 would impact the amount of solar the model adds a decade before in 2026. MidAmerican ultimately ignored these near-term results from the SMR sensitivity (likely because the outcomes were hard to explain) and instead matched the near-term builds in its Preferred Portfolio with those from the Reference Case. As a result, the only major difference between the Preferred Portfolio and the Reference Case comes in the 2030s when the SMR + salt storage is added.

Additionally, the Company's Preferred Portfolio is not the lowest-cost portfolio for customers on a net present value revenue requirement (NPVRR) basis. Over the 20-year planning timeframe, it is substantially more expensive ($830 million) than the Reference Case—due in large part to the addition of SMR + salt storage in 2036. It is higher cost than nearly all the other portfolios the Company modeled (second most expensive portfolio that MidAmerican studied).

The Preferred Portfolio scores highly in 13 of the 14 scoring metrics MidAmerican chose. But as we will discuss in the next section of our comments, many of the metrics presented at the fourth RES meeting are poorly designed and do not reflect actual value to customers. MidAmerican does not provide any discussion of why the Preferred Portfolio's performance in those metrics should outweigh the $830 million in excess costs over the Reference Portfolio or any of the other portfolios it modeled.

While we acknowledge that there will be additional resource planning processes carried out before decisions are made related to the SMR and salt storage resource, the selection in this resource planning process sets MidAmerican's baseline resource plan. MidAmerican may now devote effort and resources towards planning and preparing for SMR and salt storage instead of focusing on other resources that may be more cost effective. There is a real cost to pursuing these resources now when they have not been justified.

Recommendation:

We recommend that MidAmerican put forward a Preferred Portfolio based on economic modeling and not plan around the hand-picked SMR + salt storage resources. The Company should also focus on understanding the resource characteristics that it will need in the mid-2030s (that were to be provided by the SMR + salt storage) rather than focusing on the specific speculative technology.

III. Scoring and ranking

MidAmerican designed a scoring and ranking methodology to compare its portfolios to one another (Figure 1). Utilities often use scorecards to compare portfolio results across a variety of metrics, and they can be valuable tools to help synthesize results and inform long-term decision making. But MidAmerican's scorecard design and methodology is not aligned with best practices in resource planning. The individual metrics that MidAmerican uses are problematic in a number of ways (discussed below), with some appearing biased against renewables, for example, by not considering the contribution of renewables to system reliability. And MidAmerican appears to have engineered its scoring and ranking methodology to favor its Preferred Portfolio even though it is $830 million more expensive than the Reference Portfolio on a 20-year PVRR basis.

MidAmerican assigns each portfolio a 1, 2, or 3 based on its performance in the Company's portfolio metrics. For each portfolio, the Company adds the score in each of the 14 metrics to arrive at a portfolio score. This process inherently assigns each metric equal importance in determining a portfolio's score by using the same three point scale. Different metrics deserve a different weight in importance. For example, cost should carry significantly more weight in evaluating a portfolio than jobs, but both metrics are the same under MidAmerican's approach.

In the RES presentation, MidAmerican does not offer an explanation of how MidAmerican determined each score and what differentiates the scores across metrics and portfolios. The company could have applied an empirical approach, such as defining quantiles or outlier distributions among metrics, to assign scores to performance metrics. Doing so would have aided the transparency of the scorecard. It is unclear what methodology the Company used to assign scores to portfolios. Rather it seems the Company relied on subjective evaluation of the data to bin metrics to scores. Without greater explanation and context, it is unclear if the differentiation is actually meaningful. A modest difference in jobs may result in the same scoring differential as hundreds of millions of dollars in cost differential.

MidAmerican's scoring and ranking inappropriately weigh factors to lead to the selection of the Preferred Portfolio. While minimizing long-term PVRR is not the only consideration in resource planning, it should be the main focus of resource planning. It is problematic that MidAmerican's scoring and ranking methodology assigns 20-year PVRR a weighting of only about 7 percent, equal to the weighting given to metrics such as "fuel abundance" and "jobs."[4]

A better approach would be to create a scorecard where the results for each metric are presented in relevant units—i.e. NPVRR metrics in dollars, CAGR change in $/MWh, carbon emissions in tons of emissions for the total portfolio, etc. This type of scorecard communicates the differences across scenarios much more clearly than a simple numerical ranking. AES Indiana's Scorecard provides a good example of an evaluation framework with results clearly displayed in their

[4] MEC's meeting 4 presentation, at 32.

relevant metrics.[5] Layered on top of this type of scorecard would be a clear explanation for how the metrics are weighted in decision making about the portfolio.

Recommendations:

MidAmerican should develop a scorecard that clearly displays key quantitative metrics in the relevant units across the portfolios.

MidAmerican should include an explanation of how scores were assigned to portfolios and workpapers demonstrating the calculation.

MidAmerican's portfolio scores should not be used to select a portfolio. While portfolio scores can provide useful and interesting information to compare portfolios, MidAmerican's portfolio scoring is not a fair or accurate means of evaluating cost and risk for customers.

Scoring Metrics

In the following discussion, we provide a critique of, and recommendations to improve many of MidAmerican's specific metrics.

Figure 1: MidAmerican portfolio scorecard

► 1 (most preferred) to 3 (least preferred)

Criteria	Metric	Preferred Portfolio	Scenario 1 – Reference Case	Scenario 2 – Early Retirement	Scenario 5 – DLOL	Scenario 7 – EPA	Combined Cycle Sensitivity	SMR Sensitivity	SMR with Salt Storage Sensitivity	Battery Storage Sensitivity
Affordability	NPV 10-Year	1	1	3	3	3	2	1	1	3
	CAGR Cost 10-Year	1	2	3	2	3	1	1	1	2
	NPV 20-Year	2	1	2	2	3	1	2	2	2
	CAGR Cost 20-Year	2	2	1	1	2	1	2	2	1
	High/Low Gas	1	2	3	2	2	2	1	1	1
	Foreign market	1	2	2	1	2	2	2	1	1
	Fuel Abundance	1	2	2	3	2	3	1	1	1
Reliability	Market Purchases	2	2	3	2	3	1	2	2	2
	Uncovered load	1	2	2	1	2	1	2	2	3
	Fuel Diversity	1	3	3	2	3	2	2	1	2
	Conventional + Storage	2	2	2	1	2	2	2	2	2
Sustainability	CO_2 (10 year)	2	2	1	2	1	3	2	2	2
	CO_2 (20 year)	2	2	1	3	1	3	2	2	2
	Jobs	1	2	3	1	2	1	1	1	2
Total Score		20	27	31	26	31	25	23	21	26

[5] AES Indiana 2022 IRP, Volume 1 at xxvii. Available at https://www.aesindiana.com/sites/default/files/2022-12/AES-Indiana-2022-IRP-Volume-I.pdf

Affordability: 10-year NPV and 20-year NPV

MidAmerican includes both a 10- and 20-year NPV. It is common practice for utilities to include a short and long-term NPV in a scorecard. The 10-year NPV tells more about the cost of the near-term action plan while the 20-year NPV covers the cost of the entire study period. But in this case, the 10-year NPV metric does not include the costs of the SMR + salt storage resources, which come online just beyond the 10-year window. The Preferred Portfolio appears to be low cost on a 10-year PVRR basis—lower than the Reference Case[6]—but it is not clear what is driving that difference. The quantity of Solar PV, CT, and Storage is identical across the two scenarios. But once the SMR + salt storage costs are included; the Preferred Portfolio no longer receives a low-cost ranking (based on the 20-year NPV metric).

Affordability: 10-year Compound Annual Growth Rate (CAGR) and 20-year CAGR

MidAmerican also includes two metrics to measure how generation costs change on a $/MWh basis over time. The Company includes metrics for CAGR in $/MWh costs for the first ten years and the entire study period. While change in cost per MWh over time is important, the metric is not discounted so it doesn't capture the dynamic of weighing short-term costs more than long-term costs. And while the 10- and 20-year $/MWh CAGR will differ from one another, MidAmerican has not adequately justified why it should include both. By including two CAGR metrics, the company has effectively given CAGR equal weighting to the discounted NPVRR metric.

Recommendation

MidAmerican should clearly explain why the 10-year CAGR of the Preferred Portfolio is lower than the Reference Case.

MidAmerican should explain the reasoning behind using two $/MWh CAGR metrics and consider a different discounted metric or at least using only one CAGR metric instead of two.

Affordability: Scoring metric: Foreign market

It is reasonable and prudent for MidAmerican to consider the risk of exposure to global markets and geopolitical instability in long-term planning. However, it is unclear how exactly MidAmerican is determining its rankings. The Company discusses a number of considerations that go into this ranking—including "exposure to global markets and their associated volatility, geo-political instability, regulatory and legislative uncertainty, and local public reaction to a particular type of development."[7] The Company also cites that smaller, distributed resources are less likely

[6] MEC's meeting 4 presentation, at 63.
[7] MEC's meeting 4 presentation, at 19.

to have electric delivery impacts from political instability.[8] But each of these themselves could be ranked and weighted.

For the Preferred Portfolio that includes nuclear and salt storage, MidAmerican assigned it the highest ranking in this category. But nuclear fuel is not produced in great quantities domestically. Only five percent of uranium used domestically was sourced domestically in 2023.[9] Additionally, it seems possible that MidAmerican is considering a TerraPower Natrium nuclear plant, similar to the 345 MW Natrium nuclear plant with 155 MW of salt storage proposed by PacifiCorp in its recent IRP.[10] In this case, Natrium nuclear plants are expected to require high assay, low enriched uranium (HALEU) fuel. This type of fuel has not been manufactured in the US historically, although TerraPower is making efforts to develop a fuel fabrication facility. [11,12]

Affordability: Fuel abundance

MidAmerican also considers fuel availability and stability. The Preferred Portfolio and nuclear portfolios again score highly on the "fuel abundance" metric. But MidAmerican provides no details or explanation on its assumed fuel supply or fuel source for the SMR + salt storage resources. The Preferred Portfolio is ranked higher than the Reference Case on this metric—and given that the main difference is that the Preferred Portfolio has SMR instead of a CT, it would appear that MidAmerican is ranking the fuel supply for nuclear as more stable than that for gas. Given the nuclear supply issues discussed above, MidAmerican needs to justify its assumptions.

Recommendation:

MidAmerican should reassess its "foreign market" metric and "fuel abundance" metric as they apply to nuclear fuel appropriate for the nuclear generator studied in this IRP.

Reliability: Market purchases

MidAmerican's market purchases "reliability metric" does not adequately measure reliability in MidAmerican's portfolios. A better study of reliability would look at market purchases during the riskiest hours as measured by the loss of load probability (LOLP) metric or as approximated using peak load hours. By using a 20-year sum of all market purchases, the Company has developed a

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[8] MEC's meeting 4 presentation, at 19.

[9] EIA 2023 Uranium Marketing Annual Report, at 2. Accessed 11/20/2024 at: https://www.eia.gov/uranium/marketing/pdf/2023%20UMAR.pdf

[10] PacifiCorp 2023 Integrated Resource Plan. Page ix. Accessed 11/20/2024 at: www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/energy/integrated-resource-plan/2023-irp/2023_IRP_Volume_I.pdf

[11] Sonal Patel. Power. Nuclear Fuel Facility Unveiled for Natrium Fast Reactor Demonstration. October 27, 2022. Accessed on 11/20/2024 at: https://www.powermag.com/nuclear-fuel-facility-unveiled-for-natrium-fast-reactor-demonstration/

[12] World Nuclear News. Agreement ensures demo Natrium plant's HALEU needs will be met. July 18, 2023. Accessed 11/20/2024 at: https://www.world-nuclear-news.org/Articles/Agreement-ensures-demo-Natrium-plant-s-HALEU-needs

metric that would be appropriate for measuring market price risk, but does not speak to system reliability.

First, the metric includes low-load hours when there is little to no system reliability risk, and it weights them equally to hours with a high loss of load risk. A true measure of reliability would place more emphasis on high-risk hours.

Second, the metric does not differentiate between purchases made to meet system capacity needs and purchases made for economic reasons. Such a metric has the potential to be an inaccurate measure of reliability. For example, if the Company modeled a portfolio with a large number of gas CT peaking resources to meet peak system needs, the portfolio might also include a high level of low-cost, off-peak market purchases. The off-peak market purchases would cause the portfolio to underperform in terms of this "reliability metric," when in fact the portfolio might include a higher level of dispatchable, flexible resources than other portfolios.

Recommendation

MidAmerican should refine any market purchase metric to focus on high risk and high load hours rather than treat all market purchases as a reliability measure.

Reliability: Uncovered load

MidAmerican includes a portfolio metric that looks at the total amount of "uncovered load" in each portfolio. MidAmerican defines uncovered load as a MWh that cannot be served by dispatchable thermal or storage resources on MidAmerican's system. Renewable energy is excluded from the calculation for the purpose of scoring portfolios.

This metric is methodologically unsound. Renewable energy makes valuable contributions to system reliability that must not be overlooked when planning to serve load at a reasonable cost. The calculation of "uncovered load" by setting wind and/or solar resources to zero is not a well-accepted practice, and it does not constitute a reliability study. Recent severe storms in the Eastern U.S. have highlighted the dependence on thermal resources that may not be able to operate. As EI stated in the Summer Preparedness filing earlier this year, there is now evidence that forced outage rates increase with extreme temperatures, both high and low.[13] MidAmerican did not describe any such study that accounts for higher forced outage rates of thermal resources, which would be much more plausible than running cases with wind and/or solar set to 0 MW each hour.

In recent years, planners have thought carefully about how to consider reliability in systems with substantial amounts of variable renewable energy. Resource adequacy modeling can more robustly address this issue—both on the front end in evaluating the contribution of an individual resource,

[13] "Comments of Environmental Law & Policy Center, Iowa Environmental Council, and Sierra Club," Docket No. INU-2024-0001 (filed May 22, 2024).

and after the portfolio is created, in determining how the resources in aggregate perform under extreme weather events. Generally, resource adequacy modeling involves modeling dozens or hundreds of historical weather years. For resource accreditation, the modeling produces probabilities to credit renewables for their contribution to system reliability and ability to serve system peak, without overestimating their contribution.[14] For portfolio performance, utilities can run their key portfolios through resource adequacy modeling (for specific years) to test how the system performs against hundreds of iterations of different normal and extreme weather conditions.

Resource adequacy studies are most commonly based upon LOLE (loss of load expectation) studies that consider the impact of forced outages rates on resource availability. As MidAmerican says in its presentation, it is important to assess whether a given resource mix can supply demand at all times. However, MidAmerican has not presented any analysis of how thermal forced outage rates impact resource adequacy. MidAmerican may have used accredited capacity, not rated capacity, in its modeling but that is not stated. Using accredited capacity for each thermal unit may be overly conservative. Compared to a reliability study that uses rated capacity and forced outage rates for all thermals, the use of accredited capacity is similar to assuming that all forced outages happen all the time. A reliability model would use a sequential Monte Carlo to estimate the stochastic impact of forced outage rates on resource adequacy. In a reliability study such as this, in any given hour some plants could be producing full output while others are on either partial or full forced outage. The capacity that results from such calculations would be higher than the capacity that emerges from MidAmerican's analysis. MidAmerican's approach reduces the level of planning reserve beyond what a reliability model would produce, which could result in a higher estimate of new resource needs.

Overall, MEC's analysis of reliability falls short of best practices, and it does not measure resource adequacy, nor does it measure long-term reliability. The Company does not rely on LOLE or Effective Load Carrying Capacity (ELCC) studies - which are commonly used by RTOs and utilities to develop reliable systems and portfolios. Instead, MidAmerican analyzes "aspects of reliability" but the Meeting 4 presentation does not refer to a real resource adequacy study.

By using a metric that credits only dispatchable resources, rather than performing robust resource adequacy modeling, MidAmerican is undervaluing the reliability of portfolios that include more renewable energy.

[14] Juan Pablo Carvallo Et al. Lawrence Berkeley National Laboratory. A Guide for Improved Resource Adequacy Assessments in Evolving Power Systems. June 2023. Page ix.

Recommendation:

MidAmerican should stop using its "uncovered load" and "market purchases" reliability metrics and rely on more accurate metrics such as ELCCs and resource adequacy studies that adequately consider the reliability contribution of renewable energy.

We appreciate the commitment by MidAmerican to a transparent and collaborative planning process, and look forward to discussion of this feedback. Please do not hesitate to contact us with questions prior to a written response.

Respectfully submitted November 22, 2024.

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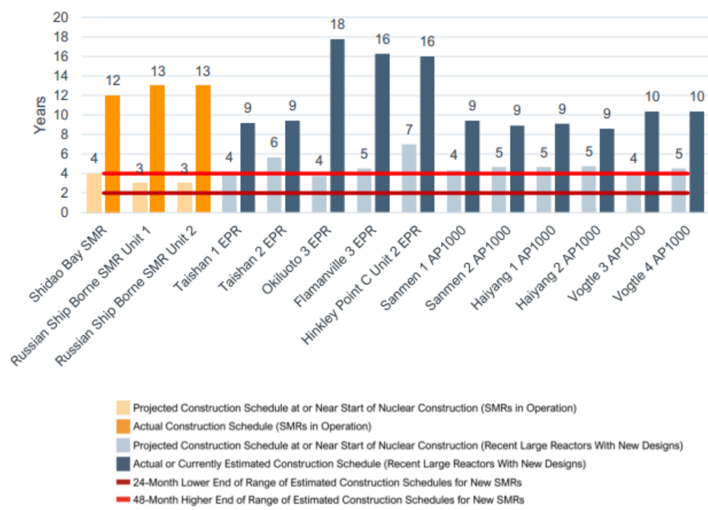
Appendix 1: Small Modular Reactor Uncertainty

The development and deployment of Small Modular Reactors (SMRs) in the United States is marked by significant uncertainty.

- There are no SMRs running in the US yet.
- First-of-a-kind projects are inherently risky and prone to delays as technical and logistical issues emerge.
- Most nuclear construction projects exceed original schedules:[15]



Source: IAEA Power Reactor Information System, EDF, 2023 World Nuclear Industry Status Report.

- Other concerns
  - The U.S. nuclear industry has warned that the rollout of certain SMR designs could be delayed by years due to a shortage of high-assay low-enriched uranium (HALEU) fuel. Currently, 90% of advanced reactor designs funded by the U.S. government will require HALEU within the next decade.
  - Some SMRs, particularly those using coolants other than water, could generate new forms of radioactive waste, and so countries planning to deploy SMRs need to plan to manage these new waste types.[16]
  - NuScale Power and the Utah Associated Municipal Power Systems canceled the 462-MW SMR project, which was to be the first such power plant in the U.S.[17]

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[15] https://ieefa.org/sites/default/files/2024-05/SMRs%20Still%20Too%20Expensive%20Too%20Slow%20Too%20Risky_May%202024.pdf

[16] INTERNATIONAL ATOMIC ENERGY AGENCY, Small Modular Reactors: Advances in SMR Developments 2024, Non-serial Publications , IAEA, Vienna (2024)

[17] https://www.utilitydive.com/news/nuscale-uamps-terminate-small-modular-nuclear-reactor-smr-project-idaho/699281/#:~:text=In%20January%2C%20NuScale%20raised%20the,Institute%20said%20in%20an%20email.

Appendix 2: Resource Adequacy References

Relevant references include:

- Resource adequacy description: “Resource adequacy is measured by the probability of an outage due to insufficient capacity. It is measured at the system level to capture the overall impact of outages of individual components including generators and transmission.” https://www.nrel.gov/research/resource-adequacy.html.
- G. Calabrese, "Generating Reserve Capacity Determined by the Probability Method," in Transactions of the American Institute of Electrical Engineers, vol. 66, no. 1, pp. 1439-1450, Jan. 1947, doi: 10.1109/T-AIEE.1947.5059596.
- L. L. Garver, "Effective Load Carrying Capability of Generating Units," in IEEE Transactions on Power Apparatus and Systems, vol. PAS-85, no. 8, pp. 910-919, Aug. 1966, doi: 10.1109/TPAS.1966.291652
- North American Electric Reliability Corporation. Integrating Variable Generation Task Force on Probabilistic Methods Team. M. Milligan and M. O’Malley, leads. (2011). Methods to Model and Calculate Capacity Contributions of Variable Generation for Resource Adequacy Planning. Available at https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/IVGTF1-2.pdf
- NERC Performance Analysis: https://www.nerc.com/pa/RAPA/PA/Performance%20Analysis%20DL/NERC_SOR_2024_Overview.pdf
- Ibanez, E.; Milligan, M. (2012). Impact of Transmission on Resource Adequacy in Systems with Wind and Solar Power. Proceedings of the 2012 IEEE Power and Energy Society General Meeting, 22-26 July 2012, San Diego, California. Piscataway, NJ: Institute of Electrical and Electronics Engineers (IEEE) 5 pp.; NREL Report No. CP-5500-57685. Available at http://dx.doi.org/10.1109/PESGM.2012.6343955
- Ibanez, E.; Milligan, M. (2014). Comparing Resource Adequacy Metrics and Their Influence on Capacity Value: Preprint. Probabilistic Methods Applied to Power Systems Conference, Durham, England. 8 pp.; NREL Report No. CP-5D00-61017. Pre-print available at http://www.nrel.gov/docs/fy14osti/61017.pdf.
- E. Ibanez, M. Milligan (NREL, USA) (WIW14-1063), Comparing Resource Adequacy Metrics. 13th International Workshop on Large-Scale Integration of Wind Power into Power Systems. Berlin, Germany. Nov 11-13, 2014.
- Aidan Tuohy, Eamonn Lannoye, Jody Dillon, Chris Dent, Amy Wilson, S. Zachary, E. Ibanez, M. Milligan: Capacity Adequacy and Variable Generation: Improved Probabilistic Methods for Representing Variable Generation in Resource Adequacy Assessment. Electric Power Research Institute in collaboration with National Renewable

Energy Laboratory; Heriot-Watt University, Edinburgh, UK; Durham University, Durham, UK; Ecar Energy Ltd, Ireland.

- Probabilistic Assessment of Resource Adequacy and Reliability with High Levels of Variable Energy Resources EPRI (2019) and Accreditation paper 2024
- Milligan Variance Estimates of Wind Plant Capacity Credit 1996. https://www.nrel.gov/docs/legosti/fy96/21311.pdf

ESIG Resource Adequacy Report https://www.esig.energy/resource-adequacy-for-modern-power-systems/