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Witness:	Scott Wibbenmeyer
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MISSOURI PUBLIC SERVICE COMMISSION

FILE NO. EA-2023-0286

SURREBUTTAL TESTIMONY

OF

SCOTT WIBBENMEYER

ON

BEHALF OF

UNION ELECTRIC COMPANY

D/B/A AMEREN MISSOURI

St. Louis, Missouri
December, 2023

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SURREBUTTAL TESTIMONY

OF

SCOTT WIBBENMEYER

FILE NO. EA-2023-0286

I. INTRODUCTION

Q. Please state your name and business address.

A. My name is Scott Wibbenmeyer and my business address is 1901 Chouteau Avenue, St. Louis, Missouri 63103.

Q. By whom are you employed and what is your position?

A. I am employed by Union Electric Company d/b/a Ameren Missouri ("Ameren Missouri", or "Company") as Senior Director, Renewable Business Development and Acquisitions.

Q. Are you the same Scott Wibbenmeyer who submitted direct testimony in this case?

A. Yes, I am.

II. PURPOSE OF TESTIMONY

Q. To what testimony or issues are you responding?

A. I will address Staff rebuttal testimony on the following topics:

- Project Scorecards;
- Comparisons to other Solar Project Costs;
- Staff recommended conditions;
- Environmental issues;

- Energy Generation/Project Output issues; and
- One Miscellaneous item.

Project Scorecards

Q. Staff witness Cedric Cunigan's rebuttal testimony addresses the request for proposals ("RFP") utilized by the Company in selecting the Cass County and Split Rail projects, expressing a concern on Staff's part with the Company's process in evaluating the RFPs. Is Staff's concern well taken?

A. No, Staff's concern is misplaced.

Q. Why is Staff's concern misplaced?

A. Staff witness Cunigan claims that a "higher criteria score is given to higher cost projects"; i.e., he claims that when we scored the RFP responses, we gave greater weight or credit to projects that cost more.[1] That claim is incorrect, and in fact the opposite is true.

Q. Please explain.

A. As Mr. Cunigan discusses, we ranked each RFP response using a multi-factor scorecard developed with the help of 1898 and Company, the consulting division of Burns & McDonnell. I will discuss the overall scorecard process in more detail below. The cost (price) of a project under a build transfer arrangement (the project structure employed for Split Rail) or a development transfer arrangement (the project structure employed for Cass County) is one of the criteria used to score each project. Below is a screenshot of the price criteria on the scorecard:

[1] Cedric Cunigan Rebuttal Testimony, p. 10.

Total BTA Price rank: top 25%	5
Total BTA Price rank: middle 50%	3
Total BTA Price rank: bottom 25%	1

As Mr. Cunigan indicated, a score of 1, 3, or 5 was assigned to each project. However, Mr. Cunigan has misinterpreted the scorecard. He apparently took "top 25%" to mean "*highest cost* 25%" and "bottom 25%" to mean "*lowest cost* 25%." However, Mr. Cunigan has it backwards. "Top" means lowest cost and "bottom" means highest cost. Put another way, top means the top *ranked*, or the best projects from a capital cost perspective, and "bottom" means the bottom *ranked* – i.e., worst projects from a capital cost perspective.

Q. Was this case the first case where these scorecards have been provided to Staff and discussed?

A. No. We provided these scorecards, using the same scoring system and approach (including on cost) in File Nos. EA-2022-0244 and EA-2022-0245, the Huck Finn and Boomtown dockets, respectively. Those scorecards used the same top/middle/bottom ranking approach. We provided them in this case shortly after we filed this case (case filed June 16, 2023, and Data Request ("DR") No. MPSC 0003 responded to on June 29, 2023).

Q. Had Staff brought up this (misplaced) concern that the Company was giving more credit in its scoring to higher cost projects before Mr. Cunigan filed his rebuttal testimony in this case?

A. No. While I can on the one hand understand how someone might take "top" to mean "highest," on the other hand I was and remain very surprised that (a) Staff would come to that conclusion in this case having been familiar with these scorecards for quite some time, and (b) would have accused the Company of intentionally seeking to deploy higher cost projects as

an effort to grow rate base, without at least asking the Company to clarify what top/middle/bottom meant. Staff could have asked a follow-up data request or asked us directly during one of the two technical conferences we held with them in Jefferson City (in July and August of this year), and we would obviously have clarified any confusion Staff might have had on this point. In addition, the reference itself refers to the ranking, e.g., "Total BTA price *rank"* (emphasis added). Company witness Steven Wills discusses the Company's concern with Staff jumping to the wrong conclusion in his rebuttal testimony.

Q. Am I correct that the Company has brought four different solar projects to the Commission for CCNs over roughly the past year and a half using similar scorecards, that is, the Huck Finn, Boomtown, Split Rail and Cass County projects?

A. Yes, that is correct.

Q. How did those projects score in your overall evaluation?

A. All four of those projects were scored as part of the 2020 RFP and they were among the top six projects. There were two others, **_____** solar that were also among the top six. However, the developer of the **_____** project pulled it off the market due to development issues and the developer of **_____** decided to build the project and keep it itself. We thus proceeded with the four top scoring projects that remained, two of which the Commission has approved for CCNs and two of which are proposed in this docket.[2]

[2] In addition to capital cost, projects are scored on other factors, including project size, location, ownership arrangements, project maturity, developer experience, technology and project performance, transmission interconnection criteria, constructability, locational market pricing, project pricing, tax credit qualification, status of acquisition of required land rights, status of environmental studies, and response to the form agreements included with the RFP. I should note that Split Rail was also included in the response to our 2022 RFP – it was the top scoring project in the 2022 RFP.

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Comparisons to Other Solar Project Costs

Q. Putting aside Staff's mistaken interpretation of the scoring process, are you confident that the projects proposed in this docket reflect current market pricing for solar projects?

A. Yes. All of the projects that are the subject of this docket (and prior dockets) are competitively bid and evaluated to ensure market transparency. The acquisition RFPs request several pricing components for all proposed projects, to include: Modules, Racking, Inverters, Safe Harbor Equipment (if applicable), MISO Transmission Owner's Interconnection Facilities, Affected System Transmission Network Upgrades, Project Substation, Balance of Plant, Build Transfer Fee, and other costs (including financing, sales tax, etc.). Ameren Missouri continuously monitors the market pricing for several of these pricing components through our strategic sourcing team as well as our renewable development team. During the competitive bidding process, we have insights into these cost components and the market reasonableness as compared to costs we've seen in the marketplace with our self-developed projects and other solar projects within the RFP.

Also, although it is challenging to know exactly what prices other utilities are seeing in a volatile solar market, Northern Indiana Public Service Company ("NIPSCO") published its 2022 RFP results[3] and reported an average cost of $2,129/kW-AC across fifteen solar bids received. Ameren Missouri's proposed projects and their costs fall below the average bid NIPSCO received during its similar RFP process.

[3] 2022 NIPSCO Stakeholder Oct 19, (https://www.nipsco.com/docs/librariesprovider11/rates-and-tariffs/irp/2022-nipsco-stakeholder-oct-19.pdf?sfvrsn=8b041051_3)

Q. Staff witness Hari Poudel's rebuttal testimony also suggests that Ameren Missouri's cost projections for solar are misaligned with the cost projections developed by the National Renewable Energy Lab ("NREL"). Please respond.

A. In developing projections of cost for future projects, we look closely at numerous industry sources including NREL, Lazard, EIA, and EPRI, but each capital cost estimate produced by these organizations differ slightly in methodology, in system costs included, and in regional specificity (or lack thereof). NREL's 2022 U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks report devotes several pages to a discussion of this very topic, stating that:

> "Different price benchmarks are useful for different purposes. NREL's benchmarks are primarily used for long-term projections and insights into underlying cost drivers, whereas reported market prices are useful for understanding real market dynamics. NREL benchmarks should *not* be used for purposes better met by market prices and vice versa. For instance, if an analyst wants to know the actual prices paid by real customers in a specific location at a specific time, the analyst should use reported market prices. Conversely, if an analyst wants to understand the trajectory of underlying cost drivers, the analyst should use NREL benchmarks across multiple years".[4]

The historical project cost data NREL displays on their website, available through 2020, shows a wide range for 2020 utility-scale projects with a 20th percentile cost of $1,370/kW-AC, a median of $1,680/kW-AC, and an 80th percentile of $2,370/kW-AC.[5] This spread – more than 40% between the median and 80th percentile of reported project costs – helps underscore the point made in the quote above: no single industry data source can or should provide a point estimate for expected project cost under all conditions. Considering industry research and policy trends *in combination* with

[4] https://www.nrel.gov/docs/fy22osti/83586.pdf
[5] https://atb.nrel.gov/electricity/2023/utility-scale_pv

informed, regional market price data is critical to determine realistic near and long-term resource cost estimates.

Q. What about Staff witness Hari Poudel's rebuttal testimony reference to the costs provided by Arevon for its Kelso Solar project on that project's website. Are the costs posted on the website valid, that is, do they illustrate current market pricing?

A. No, I am certain that they do not. First and foremost, we received an RFP response from Arevon for this same project for our 2020 RFP and the price at that time was **_____** more than cited to by Staff witness Poudel from the website. Given that the market has most definitely increased since 2020, there is no way Arevon is building or offering the Kelso project for $175 million.

Second, the website simply states that Kelso reflects a "$175 million local estimated investment." Arevon does not say that the $175 million is the total project cost. While I can't say with certainty what "local estimated investment" consists of, it is highly likely that it consists of the typical expenses one sees when local impacts are studied, like land lease payments, expenditures with local vendors, etc. This is likely the case as confirmed by the website's reference to a third-party Economic Impact and Land Use Analysis[6] for the project, with the website also stating (in reference to that analysis) that "The project represents an investment in excess of $175 million." In any event, whatever went into the $175 million/excess of $175 million stated on the website undoubtedly does not consist of what it would cost to build and place the project into operation, nor does it even come close to illustrating solar market pricing.

[6] Information found on Kelso Solar website 9f6acf_3297941451f34959af13d4802bd29dff.pdf (usrfiles.com)

Staff Recommended Conditions

Q. Staff witness Shawn Lange recommends that the Commission adopt a reporting condition for the Vandalia project relating to any curtailment of its output due to distribution system constraints?[7] Is such a condition necessary?

A. No. Staff witness Lange cites to standard interconnection agreement language used in interconnection agreements for connections to Ameren Missouri's 69 kV distribution network. The interconnection study for the facility, however, concluded that the distribution system is capable of handling the full capacity from the Vandalia facility and contains no suggestion that distribution system constraints would cause its production to be curtailed. We addressed this issue in our response to DR MPSC 0066, which I have attached to my surrebuttal testimony as Schedule SW-S1. As discussed in that response, as is true for any power plant connected on any line (transmission or distribution), the line could experience a forced outage (e.g., from extreme weather, or a car hitting a pole) which of course could temporarily require any plant relying on the line to curtail until the line is repaired, but there is nothing in the study that suggests the capacity or capability of the 69 kV system to which Vandalia will connect cannot handle its full output; there is nothing to suggest curtailment outside the possible but rare situation of an unplanned forced outage of the line. There is therefore no basis for the condition proposed by Mr. Lange.

Q. Are you agreeable to providing the Restoration Plans within 60 days of each project's in-service date as recommended by Staff witness Brodrick Niemeier?[8]

A. Yes, we are agreeable to this condition.

[7] Shawn E. Lange, P.E. Rebuttal testimony, p. 34.
[8] Brodrick Niemeier Rebuttal Testimony, p. 5, ll. 11-12.

Q. Will Ameren Missouri use sound engineering judgment and commercially reasonable efforts to meet the IEEE Standard P2800TM for the Projects and future transmission interconnected solar projects?

A. Yes, this is a condition we agreed upon with Staff in both the Huck Finn and Boomtown dockets and we are agreeable to it here given that Ameren Missouri will continue to work closely with each project developer and MISO, using sound engineering judgment and commercially reasonable efforts to meet the IEEE Standard P2800.

Environmental Issues

Q. Mr. Cunigan discusses environmental challenges the High Prairie Wind facility has faced and indicates the Solar Projects may also face environmental concerns – specifically the Cass County Solar Project, which has required environmental mitigation measures.[9] Is it appropriate to compare these solar projects' environmental risks with the challenges High Prairie has faced?

A. No. A solar facility is as similar to a wind farm as much as an apple is similar to an orange; an apple and orange are both fruits, just like solar and wind projects are both renewables, but they generally have significantly different environmental risk profiles. Therefore, it is not appropriate to compare what are primarily construction-related environmental issues for Cass County Solar to post-construction operational environmental-related challenges at High Prairie. This is because once Cass County Solar has been constructed and is operational, the environmental concerns for the project are minimal, whereas for High Prairie Wind after construction and while the facility is in operation, the environmental concerns increased (mostly at night during portions of the year). The testimony of Staff consistently

[9] [9] Cedric Cunigan Rebuttal Testimony, p. 11 – 12.

implies that no project should ever be pursued unless they are completely risk free. This logic is not only flawed, but impractical, as all projects – whether fueled by coal, gas, nuclear or powered by solar or wind – will carry some risk regardless of the technology selected. Since all projects can have risks, it is critical to use resources and data available to understand the risks and attempt to pursue projects where such risks can be reasonably mitigated or managed. Environmental risk is just one risk area that can exist with any project, which is why the Company includes environmental reviews as part of its diligence and scoring process and ensures the required environmental studies are completed for each project.

Q. Did the Company complete the required environmental studies for the projects in this case?

A. Yes. The required environmental studies were completed for each of the solar projects and supplied to Staff in response to DR MPSC 0147 (a copy of the response but not the studies themselves, which cover hundreds of pages, is attached to my surrebuttal testimony as Schedule SW-S2). None of the study results preclude a solar facility from being completed nor do they imply or anticipate that environmental issues would impede the operation of any of the facilities, including the Cass County facility.

Q. Were there any projects that required mitigation to further protect the environmental impacts?

A. Yes, the Cass County Solar project required certain environmental mitigation, primarily due to issues that could arise during construction. As noted in the Threatened and Endangered Species Habitat Survey Report for Cass County:

> The vast majority of the Project area is composed of regularly disturbed agricultural land (92.9%), which provides either poor or unsuitable habitat for any threatened and endangered species that may occur in the area. However,……the ornate box turtle, plains hog-nosed snake could

> inhabit the limited but unique Early Successional Grassland, Sand Prairie and Sand Forest habitat types present within the Project area. Pond WB-T01-001 may support the Illinois Chorus frog.

Based on these findings the project further evaluated the risk and mitigated such risk by developing a project specific conservation plan and executing an Authorization for Incidental Take and Implementing Agreement with the Illinois Department of Natural Resources.

Q. What is the purpose of the measures included in the Conservation Plan and Incidental Take and Implementing Agreement?

A. The Cass County mitigation and monitoring measures are in place to protect against the "take" of the Illinois Chorus Frog, Ornate Box Turtle, and Plains Hog-nosed Snake (all of which are State Threatened), which could occur as a result of crushing or burying by project traffic or heavy machinery during construction, and/or dispersal from suitable habitat due to increased noise and/or vibration. Additionally, routine operations after construction could result in take of the listed species by occasional traffic on access roads, disruption of movement with fences, and/or conversion of habitat to paved or gravel surfaces. Based on the amount of habitat impacted by the project, the number of known occurrences, an assessment of the potential effect of this project on these listed species within the project footprint, and the conservation measures included in the Cass County Conservation Plan, the Illinois Department of Natural Resources has determined that a take, as a result of the Cass County Solar project, will not reduce the likelihood of survival or recovery of the three identified species "and restoration activities over the life of the project are likely to aid in the conservation of the species." To offset potential impacts from the Project-lifetime alteration of 4.88 acres of sandy soil, the Project will restore 26.83 acres of sand prairie within one kilometer of the Illinois chorus frog locations and commit to $3,850 dollars of monetary mitigation.

In summary, while some mitigation was required for Cass County, those mitigations pose no real threat to facility operations or production.

Energy Generation and Panel Orientation

Q. Staff witness Michael Stahlman's rebuttal testimony suggests that Ameren Missouri's energy generation estimates are incorrect, based on his claim that the projects would operate at near 100% capacity for an "unreasonably high" number of hours. Please explain why this concern is misguided.[10]

A. Staff witness Stahlman raised production modeling concerns based on what he says the Staff would "anticipate" the data to show but provided no facts to support Staff's opinion of what they "anticipate."

The production estimates put forth by Ameren Missouri are in fact reasonable for a number of reasons which were either ignored or not considered by Staff at all. First, each project was modeled using PVsyst, which is the solar industry's leading software to develop project specific energy modeling. Second, the energy models were created by experienced solar engineers from each of the top developers or their contractors (EDF in the case of Vandalia and Bowling Green, Invenergy for Split Rail, and Savion for Cass County). Finally, to further assure confidence in the production models, third party independent engineers, such as 1898 & Co., were hired by Ameren Missouri to review and confirm the modeling inputs, assumptions and outputs of the project models.

Q. At a high level, how does PVsyst modeling work?

A. PVsyst is a specialized software that allows a user to input specific design parameters for each project, such as number of modules, inverters, transformer losses, select

[10] Michael Stahlman Rebuttal Testimony, p. 14, ll. 7-8.

specific equipment models for inverters, solar panels, racking along with many other design parameters. A user can also select specific historical weather data sets for the near exact location of the proposed solar facility. Based on these inputs the software utilizes a number of algorithms and statistical analysis to develop a "P50" first year estimated energy production for the solar facility. The P50 figure is the average level of generation expected in any given year, meaning throughout the project's life one would expect the project to overproduce the P50 number 50% of the time and underproduce the P50 number 50% of the time. The software can also output P75 and P90 figures as well, equating to the level of annual generation that is predicted to be exceeded in 75% and 90% of the project's years, respectively. For solar projects, P50 is typically the most utilized number for financial modeling as it in essence provides the expected average energy output from the facility. In addition, the software also has the capability of producing what is often referred to as 8,760 data: this data set is a tabular data set that represents the energy output, for each hour for a one-year simulation (i.e., 24hrs X 365 days = 8760 data points). This data merely provides a visualization of the production simulation for the inputs and statistical weather data used for the model and is not meant to be used as an actual hourly production guarantee.

Q. What could cause a project to produce at 100% capacity at times other than just at noon or around mid-day?

A. The high hourly production can be caused by a number of conditions related to weather, temperature, or solar azimuth angle due to varying solstice. However, the most influential impact of increased hourly production is created through efficient modern solar plant design by using trackers and/or maximizing the DC to AC ratio of the equipment. The plants proposed in this case will utilize single axis trackers. This means that each morning the panels

are pointed to the east to maximize their production angle with the sun, which in turn maximizes the output of the facility. As the sun moves across the sky the panels track the sun to continue to maximize production throughout the day. With a tracker design, one should expect a plant to be producing at maximum capacity earlier in the morning, more often throughout the day and later into the evening as compared to that of a solar facility which uses fixed axis modules. For a fixed axis plant, the modules are installed on stationary racking facing south. Therefore, they are typically only aligned perpendicular with the sun during mid-day hours, and one would expect highest production only around noon, or around the mid-day. But that is simply not the case for the projects proposed in this docket, which is why it makes perfect sense for the projects' projected production to be at or near maximum during many hours of the day.

In addition to using single axis tracker designs, solar plants (like those proposed in this docket) also have increased DC to AC ratios. This means a designer will install more DC solar modules than that of the nameplate of the inverters. By doing this, the project has more DC output for lower sun energy levels and therefore can reach full AC capacity earlier in the day and maintain maximum energy later into the evening, in turn producing more energy at any given hour, day and year. This design phenomenon is the key reason solar facilities, such as those proposed in this case, with tracking systems and higher DC/AC ratio have significantly higher capacity factors than those with fixed axis and low DC/AC ratios, and why it is completely expected and reasonable for the modeling to show production at or near maximum during many hours of the day.

Q. Did the production estimates for Huck Finn and Boomtown exhibit a similar production pattern?

A. Yes, because those projects also use single-axis tracking and an appropriate DC to AC ratio. Staff supported approval of the CCN for Huck Finn and raised no concern about this issue for either Huck Finn or Boomtown.

Q. Staff Witness Sarah Lange notes that Ameren Missouri's response to data request MPSC 0068 stated that the "orientation and design for each of the four solar sites (Vandalia, Bowling Green, Cass County, and Split Rail) has been aimed at optimizing maximum yearly energy production." Ms. Lange then implies the solar panels should be faced some unidentified direction to align the facilities' peak production with peak load. Should the solar panels be oriented differently?[11]

A. No, the four solar sites are designed to maximize both annual energy production and energy production for each hour the sun is shining. As discussed previously, the four solar projects will utilize a single axis tracker design, which will cause the modules to face the sun from early morning, throughout the day and until the sun sets. This design allows the maximum energy to be produced *each hour* therefore yielding as much energy as can be practically harvested from the sun with peak load. Furthermore, this maximized energy design (both hourly and annually) in turn is able to deliver the most value to customers by supplying the energy when they need it throughout the day and reducing revenue requirements from the increased generation. The design concept to orient the panels in a different direction as proposed by witness Sarah Lange would actually be detrimental to customers' bills, not to mention contradictory to the goal of maximizing

[11] Sarah L.K. Lange Rebuttal Testimony, p.76.

energy and minimizing revenue requirement impacts from the projects. But even more troubling, it would require the Company to install even more projects (i.e., to build and pay for more megawatts of solar capacity) than presently needed to make up for the lower energy production from an inefficient panel orientation, putting even more pressure on future revenue requirements. This entire concept is in direct conflict with Staff's general position that suggests we should have less renewables, not more.

Q. How does changing the orientation of the solar modules help align the solar facilities' peak production with a utilities' peak load?

A. For a single-axis tracker design the panels are installed on a racking system that tracks the sun. This means the face of the panels are able to point eastward in the morning and move westward as they track the sun until sunset. As mentioned earlier, this is the most common design for large ground mounted solar facilities because it maximizes energy production each hour, causing the total annual energy production to be higher than that of a fixed axis design.

For a fixed axis design, often used on roof tops, smaller solar facilities, or solar facilities where the terrain or other project parameters make them viable, the solar panels are mounted to a racking system that faces the solar panels south. The southward facing direction helps maximize the annual energy production, though significantly less than that of a single axis tracker, but also causes the maximum hourly output of the facility to occur mid-day, when the sun is most perpendicular to the solar panels. For fixed axis designs, one may consider orienting the panels so they face westward vs. south. The westward orientation allows the peak production point of the facility to be later in the day when the sun is most perpendicular to the solar panels, thereby aligning production more closely

with summer load. The challenge with this design is as you rotate the modules westward the morning and midday energy production is severely reduced, therefore the total annual production from the facility is significantly diminished. Over the last decade single axis tracker designs have become the industry standard, mostly because they do the very thing that needs to be achieved: produce the most energy from a solar facility *each and every hour* (including during the peak) to optimize the alignment of maximum generation with load, while also maximizing annual energy production.

Q. Would a utility use a fixed axis system and orient the modules to the west to help avoid the "duck curve"?

A. It is possible, but generally this is less common since both single axis tracking systems and/or energy storage systems are often more cost effective and deliver more flexibility to mitigate a "duck curve." However, in the case of Vandalia, Bowling Green, Split Rail and Cass County, the duck curve issue may be moot because, as admitted by Staff witness Stahlman, Staff does not believe that the addition of the proposed solar projects will result in a duck curve. The Company agrees.

Q. Staff witness Hari Poudel states that Ameren Missouri "used CF as a constant factor across the four solar projects"[12] and states that Ameren Missouri did not provide annual solar generation forecast values for all projects. Is this correct?

A. No. As discussed above, Ameren Missouri completed project-specific production modeling for each project using the industry-standard modeling tool PVsyst. For the Split Rail and Cass County projects, this modeling was initially completed by the project developer and was later reviewed and updated by an independent third-party engineering firm,

[12] Hari Poudel Rebuttal Testimony, p. 2.

1898 & Co, for additional validity. Staff was provided with numerous PVsyst assessments for both the Split Rail and Cass County projects, as well as with the report and recommendation provided by 1898 & Co, for each project. Both the Split Rail and Cass County Projects were then modeled at a customized P50 production level based on 1898 & Co's evaluation. As I will discuss further below, the PVsyst assessments provided for the Split Rail and Cass County projects initially did not include the variability for each project, a data point needed to estimate production levels *beyond* P50, simply because this was not in the initial scope of the assessments provided by the project developers or requested from 1898 & Co. However, when requested, the Company provided the project-specific variability values in response to MPSC 0132 (a copy of the response is attached to my surrebuttal testimony as Schedule SW-S3) to complement the extensive details of the initial PVsyst assessments and report.

Vandalia and Bowling Green Solar also had PVsyst modeling completed by the selected engineering, procurement, and construction firm, EDF. Once again, this modeling was site and project design specific, and each project was modeled at a P50 production level customized to the project.

Q. Can you please elaborate on the project variability metric and how Ameren Missouri considers this metric for project evaluation?

A. PVsyst estimates an annual variability in production for each project. From Ameren Missouri's experience thus far, these values for solar tend to fall in the 4-5% range, which is consistent with what the PVsyst modeling indicated for the Solar Projects at issue in

this case.[13] As a standard and slightly conservative (i.e., it understates production) assumption, the Company utilizes the lower end of that range, 5%, to estimate production levels *below* P50 for each project for the purposes of project modeling. This is much like the Company's approach to modeling panel degradation: Ameren Missouri uses a standard average assumption of 0.5% annual panel degradation, even though this value can vary slightly depending on the module manufacturer.

To summarize for clarity: the P50, or expected, production estimates modeled for each project were developed using site and project design specific assumptions. This value is by far the most important metric produced by the PVsyst analysis. The P50 estimates utilized were not a "constant factor" across all projects, as the Staff claims, but rather were customized project specific estimates of the P50 value for each project, calculated separately for each, that were provided both in the initial filing and in the workpapers supporting that filing.[14] The lower production estimates[15], P75-P99, were then calculated using the custom P50 value for each project and a conservative, standard variability estimate of 5%. The P50 value is **not** impacted by the model variability, and utilizing a variability assumption that is consistent across projects *still* results in customized estimates for lower production levels for each project because that calculation necessarily *depends* on the P50 value for each project. The Staff's focus on variability as the key metric in this

[13] One PVsyst assessment provided by the Company to Staff showed a higher variability of 11.5% for the Vandalia Solar project, which Staff witness Hari Poudel then used to produce estimated production and revenue requirement values in Table 1 and 2 in his rebuttal testimony. EDF has confirmed that this value was in error, and has reissued a corrected report, which the Company provided to Staff in a revised response to MPSC 0037. The revised response MPSC 0037REV is also attached to my surrebuttal testimony as Schedule SW-S4.
[14] Matt Michels Direct Testimony Schedule MM-D14 HC and supporting workpapers.
[15] Staff witness Hari Poudel refers to these lower production estimates as "capacity ratios."

analysis is largely misguided, and if anything is more of a scholarly debate than a topic with meaningful impacts on the decision at hand.

Miscellaneous

Q. Staff witness Brodrick Niemeier states that Ameren Missouri did not provide utility crossing data for the Cass County Project. Is that correct?

A. No. Per 20 CSR 4240-20.045, an applicant is to provide a list of all electric, gas, and telephone conduit, wires, cables and lines of regulated and non-regulated facilities, as defined in section 319.015, RSMo, which the proposed construction will cross. However, because the project site is in Illinois, it is not subject to the Missouri one-call statute, and it is my understanding that the cited regulation is inapplicable. We so stated in our CCN Application in the Boomtown docket and the Staff took no issue with our conclusion, and we so stated in our CCN Application in this case. Regardless, when Mr. Niemeier submitted DR MPSC 0183 to us just before Staff's rebuttal testimony was due (DR submitted on October 6), we provided the information in a response on October 9.

Q. Does this conclude your surrebuttal testimony?

A. Yes, it does.

Ameren Missouri's
Response to MPSC Data Request - MPSC
EA-2023-0286
For Multiple CCN Filings in 2023

No.: MPSC 0066

1. The Vandalia Interconnection Study Report includes a statement that "Significant results of this Generation Interconnection Study are outlined below: A. The Project will supply up to 52MVA of AC electric power directly to the local VNDLWLSV-42 69kV sub-transmission network circuit. System load flow analyses conclude that the Project can operate (at fixed output power factor of 97% leading) under normal system conditions with no adverse impact on the 69 kV network or local transmission system. However, operation during distribution system (n-1) contingency conditions can produce rapid voltage change (RVC) exceeding AMO's 2% limit and circuit overloading during light load conditions. To avoid exceeding acceptable RVC and circuit loading limits, AMO reserves the right to curtail Project operation during pertinent system contingency conditions." a. Please describe the frequency of occurrence of these contingency conditions. b. Please describe the physical or system conditions associated with these contingency conditions, for example, are the contingency conditions more likely to occur in hot weather or cold weather, or when area loads are very high or very low? c. Please describe the impact of any curtailment under contingency conditions on available tax benefits. d. Please describe and quantify, including all supporting documentation, the impact on the generation, potential curtailment, or changes in MISO revenue of other Ameren Missouri owned generation resources that would result from these contingency conditions. If any clarification is required concerning this data request, please contact Sarah Lange. Sarah Lange (sarah.lange@psc.mo.gov <mailto:sarah.lange@psc.mo.gov>).

RESPONSE

Prepared By: Chuck Roberts
Title: Project Manager
Date: July 20, 2023

a. Please describe the frequency of occurrence of these contingency conditions.

Contingency conditions noted in the study refer to unplanned forced outages of overhead circuits or transformers, usually due to storms. Vehicle collisions with power poles are another potential cause of forced outages for overhead circuits. Forced outage rates are expected to be similar to historical values. Outage conditions resulting in curtailment of Vandalia Solar operation are expected to be rare.

Schedule SW-S1

b. Please describe the physical or system conditions associated with these contingency conditions, for example, are the contingency conditions more likely to occur in hot weather or cold weather, or when area loads are very high or very low?

Contingency conditions due to equipment outages are not usually driven by ambient temperature or circuit loading. The occurrence of such outages tends to be random and insignificant.

c. Please describe the impact of any curtailment under contingency conditions on available tax benefits.

There would be no impact to the tax benefits related to an investment tax credit. However, if Ameren Missouri were to determine that use of the production tax credit is more advantageous to customers, there would be an impact equal to the decreased MW-hr times the PTC rate in effect at that time.

d. Please describe and quantify, including all supporting documentation, the impact on the generation, potential curtailment, or changes in MISO revenue of other Ameren Missouri owned generation resources that would result from these contingency conditions.

The contingency conditions are anticipated to be rare and are expected to have a de-minimis impact on the facility, therefore no additional information is available evaluating the impact of curtailment.

Ameren Missouri's
Response to MPSC Data Request - MPSC
EA-2023-0286
For Multiple CCN Filings in 2023

No.: MPSC 0147

Separately for each of the four solar projects proposed in this docket, 1. Please provide a complete copy of all environmental studies required for the proposed solar project. 2. Please provide a narrative timeline of events and explanation of the need and the process for each such study. 3. Do the studies indicate future costs for Ameren Missouri such as, but not limited to mitigation measures? Please explain in detail, including an estimation of such costs. 4. Please update as additional information becomes available. Requested by: (Paul.amenthor@psc.mo.gov <mailto:Paul.amenthor@psc.mo.gov>)

RESPONSE

Prepared By: Julianne Randazzo
Title: Career Environmental Scientist
Date: 8-29-23

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20 CSR 4240-2.135(2)(A)8
(Attachments Only)

All attachments have been placed on *Ameren Missouri Legal Regulatory SharePoint External site* at:
https://ameren.sharepoint.com/sites/XAMMOREGFILESHARE/Case/Forms/AllItems.aspx
If you have not accessed in the past for this case, please email Geri Best at AmerenMOService@ameren.com.

Split Rail

1) Environmental studies for the Split Rail Solar Project include:
    a. Site Characterization Study
        i. Prepared by: Western EcoSystems Technology, Inc.
        ii. Dated: November 20, 2019
        iii. Purpose: The purpose of this study is to identify potential wildlife or sensitive habitat issues within the project area.

    b. Cultural Resources Desktop Literature Review

i. Prepared by: In Situ Archaeological Consulting
ii. Dated: July 23, 2019
iii. Purpose: The purpose of this study is to identify any prehistoric and historic cultural resources within the project area and any properties listed in the National Register of Historic Places (NRHP).

c. State Historic Preservation Office correspondence
   i. Prepared by: In Situ Archaeological Consulting
   ii. Dated: February 2, 2021
   iii. Purpose: The purpose of this letter is to formally confirm that the project is not subject to Section 106 compliance and therefore, no Phase 1 Cultural Resources Survey is required.

d. Phase I Environmental Site Assessment (ESA)
   i. Prepared by: KTA Associates, Inc.
   ii. Dated: February 28, 2021 – updated March 11, 2021
   iii. Purpose: The purpose of this report is to evaluate the environmental conditions of the project site, particularly to identify any recognized environmental conditions (RECs) and evaluate the likelihood and potential impact on any identified RECs.

e. Wetland Delineation Report (2020)
   i. Prepared by: Hanson Professional Services, Inc.
   ii. Dated: November 2020
   iii. Purpose: The purpose of this report is to determine whether there are any wetlands or waterbodies within the project site that would be considered "Waters of the United States" under Section 404 and Section 401 of the Clean Water Act (CWA).

f. Wetland Delineation Report Revision (2022)
   i. Prepared by: Hanson Professional Services, Inc.
   ii. Dated: November 2022
   iii. Purpose: The purpose of this report is to determine whether there are any wetlands or waterbodies within the project site that would be considered "Waters of the United States" under Section 404 and Section 401 of the Clean Water Act (CWA). Hanson conducted a supplemental wetland delineation site visit on November 1, 2022 and submitted a revised Wetland Delineation report.

g. Wetland Delineation Addendum (2023)
   i. Prepared by: Hanson Professional Services, Inc.
   ii. Dated: February 2023
   iii. Purpose: The purpose of this addendum is to review the previously delineated features detailed in the Wetland Delineation report dated November 2022 against the “Revised Definition of ‘Water of the United

States'" rule (2022 WOTUS Rule) published in the Federal Register on January 18, 2023 and taking effect March 20, 2023.

h. Wetland Delineation Revision (2023)
    i. Prepared by: Hanson Professional Services, Inc.
    ii. Dated: April 2023
    iii. Purpose: The purpose of this revised report is to review the previously delineated features detailed in the Wetland Delineation report dated November 2022 against the final "Revised Definition of 'Water of the United States'" rule (2022 WOTUS Rule) published in the Federal Register on January 18, 2023 and taking effect March 20, 2023.

i. The Missouri Department of Conservation Natural Heritage Report
    i. Prepared by: Western EcoSystems Technology, Inc.
    ii. Dated: November 30, 2020
    iii. Purpose: The purpose of this report is to identify public lands and sensitive resources known to have been located close to and/or potentially affected by the proposed project.

j. The Missouri Department of Conservation Natural Heritage Review Report
    i. Prepared by: Western EcoSystems Technology, Inc.
    ii. Dated: July 15, 2022
    iii. Purpose: The purpose of this report is to identify public lands and sensitive resources known to have been located close to and/or potentially affected by the proposed project.

k. Vegetation Site Management Plan
    i. Prepared by: RES, LLC
    ii. Dated: May 2021
    iii. Purpose: The purpose of this report is to develop a vegetation management and soil plan that establishes permanent, regionally appropriate vegetative cover efficiently and effectively within the project and minimize future erosion, establishment of undesirable species, and maintenance costs.

l. Decommissioning and Site Reclamation Plan
    i. Prepared by: Westwood Professionals Services
    ii. Dated: April 20, 2021
    iii. Purpose: This plan includes provisions intended to ensure that the solar facilities are properly removed after their useful life.

2) Please see item (1) for the date on which each study was completed, and the high level purpose for each study. Further details on the process and results for each study can be seen in the attachments provided.

3) Mitigation measures are not required for the Split Rail Solar Project. Future costs related to decommissioning are included in the Decommissioning and Site Reclamation Plan.

Cass County

1) Environmental studies for the Cass County Solar Project include:
    a. Critical Issues Analysis
        i. Prepared by: Ecology & Environment Inc.
        ii. Dated: December 5, 2017
        iii. Purpose: The purpose of this desktop study to determine if there were any obvious development constraints that could potentially impact the Project.

    b. Desktop Cultural Resources Review
        i. Prepared by: Ecology & Environment Inc.
        ii. Dated: March 8, 2019
        iii. Purpose: The purpose of this study is to review cultural resources within and around the Project boundary.

    c. Phase I Archaeological Survey Report
        i. Prepared by: Gray & Pape Heritage Management
        ii. Dated: August 17, 2021
        iii. Purpose: The purpose of this survey was to identify, document, and provide an initial assessment of the National Register of Historic Places eligibility of any archaeological resources that may be present within the Area of Potential Effects.

    d. Phase I History/Architecture Survey Report
        i. Prepared by: Gray & Pape Heritage Management
        ii. Dated: August 19, 2021
        iii. Purpose: The purpose of this survey was to identify, document, and provide an assessment of the National Register of Historic Places eligibility of any historic architectural resources, defined as those that have reached 50 years of age or older, that may be present within the Area of Potential Effects.

    e. Phase I ESA (2020)
        i. Prepared by: August Mack Environmental, Inc.
        ii. Dated: May 29, 2020
        iii. Purpose: The purpose of this report is to evaluate the environmental conditions of the project site, particularly to identify any recognized environmental conditions (RECs) and evaluate the likelihood and potential impact on any identified RECs.

    f. Phase II ESA
        i. Prepared by: August Mack Environmental, Inc.
        ii. Dated: November 18, 2020
        iii. Purpose: The purpose of this investigation was to investigate the RECs identified in the Phase I ESA. This report includes a summary of field

activities, sampling procedures, laboratory analytical results, and conclusions.

g. Refreshed Phase I ESA (2022)
    i. Prepared by: Environmental Consulting & Technology, Inc.
    ii. Dated: December 1, 2022
    iii. Purpose: The purpose of this survey was to identify current, historical, and controlled RECs and de minimis conditions in connection with the property, to the extent feasible pursuant to the processes prescribed in the ASTM E2247-16 guidelines.

h. Wetland Delineation Report
    i. Prepared by: Ecology and Environment, Inc.
    ii. Dated: August 31, 2020
    iii. Purpose: The purpose of this report is to determine whether there are any wetlands or waterbodies within the project site that would be considered "Waters of the United States" under Section 404 and Section 401 of the Clean Water Act (CWA).

i. Threatened and Endangered Species Habitat Survey Report
    i. Prepared by: Ecology and Environment, Inc.
    ii. Dated: September 25, 2020
    iii. Purpose: The purpose of this study is to assess potential habitat availability for federally and/or state-listed T/E species in the Project area.

j. Conservation Plan
    i. Prepared by: Environmental Consulting & Technology, Inc.
    ii. Dated: March 2022
    iii. Purpose: On behalf of the Applicant, Environmental Consulting and Technology, Inc. ("ECT") has prepared this Conservation Plan for the Illinois chorus frog ("ICF"; Pseudacris illinoensis), ornate box turtle ("OBT"; Terrapene ornata), plains hog-nosed snake ("PHNS"; Heterodon nasicus), and regal fritillary butterfly ("RFB"; Speyeria idalia) in support of the Applicant's efforts to develop the Cass County Solar Project ("Project") in Beardstown and Hagener Townships, Cass County, Illinois (Appendix A: Figure 1. Project Location Map). This Cass County Solar Conservation Plan has been prepared in accordance with Title 17, Chapter I (c), Section 1080 of the Illinois Administrative Code (Incidental Taking of Endangered or Threatened Species). In accordance with Section 1080, the Illinois Department of Natural Resources ("IDNR") can authorize the incidental take of species listed as endangered or threatened by the State of Illinois with an approved Conservation Plan.

k. Preliminary Vegetation Plan
    i. Prepared by: Environmental Consulting & Technology, Inc.
    ii. Dated: March 20, 2020

iii. Purpose: The Plan describes appropriate procedures to ensure compliance with Section 16.5-6 (f) Commercial/Large Scale Solar Systems ("CSES") of the Cass County Zoning Ordinance requirements, including clearing and revegetation strategies. This Plan will describe appropriate procedures for implementing the use of native plants and pollinator friendly species, providing strategies for invasive plants and noxious weed control, and maintenance and monitoring methods over the lifetime of the Project.

l. Environmental Management Plan
   i. Prepared by: Kiewit Power Constructors
   ii. Dated: 06/29/2023
   iii. Purpose: The goal of Kiewit's environmental program is to maintain a project site that minimizes impacts on the environment and is compliant with all applicable environmental agency permits and government regulations. This Environmental Plan (Plan) will remain in effect and be followed for the duration of the project. The Plan is a living document and will be revised and approved as necessary.

m. Decommissioning Plan
   i. Prepared by: Environmental Consulting & Technology, Inc.
   ii. Dated: March 8, 2023
   iii. Purpose: This Plan was prepared to ensure proper decommissioning of the Project and to meet the requirements of Section 16.5 Cass County Solar Energy Systems Ordinance of the Cass County Zoning Ordinance ("Zoning Ordinance") and the Agricultural Impact Mitigation Agreement ("AIMA") that will be entered into by Cass County Solar, and its successors or assignees ("Owner").

2) Please see item (1) for the date on which each study was completed, and the high level purpose for each study. Further details on the process and results for each study can be seen in the attachments provided.

3) Mitigation measures are required for the Cass County Solar Project due to adverse impacts on the Illinois chorus frog (ICF), ornate box turtle (OBT), and hog-nosed snake (HNS). To offset impacts from the Project-lifetime alteration of 4.88 acres of sandy soil, the Project will restore 26.83 acres of sand prairie within 1 km of ICF locations and commit to $3,850 dollars of monetary mitigation. Further information on the mitigation measures is provided in the Conservation Plan. Additionally, future costs related to decommissioning are included in the Decommissioning Plan.

Vandalia

1) Environmental studies for the Vandalia Solar Project include:
   a. Waters of the US Delineation Report

i. Prepared By: Civil & Environmental Consultants, Inc.
ii. Dated: November 2020
iii. Purpose: Determine what areas of the project site fall under jurisdiction of US Army Corps of Engineers as wetlands.

2) Please see item (1) for the date on which each study was completed, and the high-level purpose for each study. Further details on the process and results for each study can be seen in the study itself, which was attached to the response to MPSC 0148.

3) Mitigation measures are not required at this time for the Vandalia Solar Project.

Bowling Green

1) Environmental studies for the Bowling Green Solar Project include:
   a. Waters of the US Delineation Report
      i. Prepared By: Wood Environment and Infrastructure Solutions, Inc.
      ii. Dated: November 2020
      iii. Purpose: Determine what areas of the project site fall under jurisdiction of US Army Corps of Engineers as wetlands.

2) Please see item (1) for the date on which each study was completed, and the high level purpose for each study. Further details on the process and results for each study can be seen in the study itself, which was attached to the response to MPSC 0148.

3) Mitigation measures are not required at this time for the Bowling Green Solar Project.

Ameren Missouri's
Response to MPSC Data Request - MPSC
EA-2023-0286
For Multiple CCN Filings in 2023

No.: MPSC 0132

In Ameren's DR0037-PVSyst-Simulation Report, the exceedance probabilities, such as P50, P75, and P90, were provided. Ameren supplied the probability distribution function used for presenting these probabilities in the distribution function. According to the US National Renewable Energy Laboratory (NREL), the distribution function works well when the data is normally distributed. Please provide the mean and standard deviation for a dataset that was presumed to follow a normal distribution for each of the four projects. Also provide the source and timeframe of the datasets used in the calculation of the annual production probability. Hari Poudel (hari.poudel@psc.mo.gov <mailto:hari.poudel@psc.mo.gov>).

RESPONSE

Prepared By: Brad Corder
Title: Sr. Project Manager
Date: 08/15/2023

PVsyst's standard output is a P50 annual production output when typical meteorological year (TMY) data is the input data. The P50 output from PVsyst is the mean of the distribution of potential production outputs, whether presented in MWh or as a capacity factor. The P50 output is the mean of the distribution of potential production outputs, because it is generated using the TMY datasets and TMY datasets are based on long-term average meteorological conditions. Accordingly, the P50 outputs provided (seen by project in Schedule MM-D14 labeled "Annual MWh," among other locations) are the mean of each probability distribution.

PVsyst's tool generates a "global variability" that considers the meteorological data variability, simulation uncertainties, and parameter uncertainties. The "global variability" determined by PVsyst is the standard deviation used along with the shape of the normal distribution to calculate the annual P75 and P90 values. The correlation between annual irradiance and annual variability identified by "Global irradiation: average and typical year, and year-to-year variability", a research report of the Institute of the Environmental Sciences at the University of Geneva in 2011 was utilized and applied by PVsyst to determine meteorological data variability.

To calculate P75 and P90 values, a standard deviation of 4.3% would be applied for Cass County, a standard deviation of 4.5% would be applied for Split Rail, a standard deviation of

4.1% would be applied for Vandalia, and a standard deviation of 4.2% would be applied for Bowling Green. For the project modeling provided in this case, a conservative standard deviation of 5% was assumed for all four projects.

SolarAnywhere data is site specific and contains measurements from 1998 to 2021 to determine TMY data. The sites are selected from available tiles which have a resolution of 10 km x 10 km and are evenly distributed across the United States. The data pulled for Cass County, Split Rail, Vandalia, and Bowling Green are from tiles corresponding to each project site location.

More information on how SolarAnywhere generates their TMY data can be found at the link here: https://www.solaranywhere.com/support/historical-data/typical-year/

Further information on how PVsyst handles variability, uncertainties, and the correlation between the annual irradiance and annual variability for meteorological data can be found in PVsyst's help documentation. Specifically the section "P50 - P90 evaluations" covers these topics and can be found at the following link: https://www.pvsyst.com/help/p50_p90evaluations.htm.

Schedule SW-S3

Ameren Missouri's
Response to MPSC Revised
EA-2023-0286
For Multiple CCN Filings in 2023

No.: MPSC 0037 REV

Please provide the P50, P75, and P90 hourly generation shapes for proposed projects of Split Rail, Cass County, Vandalia, and Bowling Green. Data Request submitted by Shawn Lange (Shawn.Lange@psc.mo.gov <mailto:Shawn.Lange@psc.mo.gov>)

RESPONSE: (Do not edit or delete this line or anything above this. Start typing your response right BELOW Date.)
Prepared By: Lindsey Forsberg
Title: Strategy Consultant, Renewable Energy Development
Date: November 9, 2023

CONFIDENTIAL
20 CSR 4240-2.135(2)(A)8
(Attachment Only)

The PVsyst report provided for the Vandalia project in response to MPSC 0037 shows a variability value of 11.5%. However, this value should match the value shown in the initial PVsyst report (provided in response to MPSC 0008) of 4.1%. After conferring with developer EDF, who completed the modeling, they have reissued a corrected report and apologize for any confusion this has caused. The corrected report is attached to this response.

P

EA-2023-0286

Schedule SW-S4 Attachment is Confidential in its Entirety

P

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

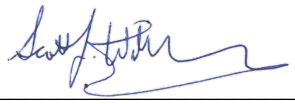
In the Matter of the Application of Union Electric Company d/b/a Ameren Missouri for a Certificate of Convenience and Necessity for Solar Facilities	)))	EA-2023-0286

AFFIDAVIT OF SCOTT WIBBENMEYER

STATE OF MISSOURI)
) ss
CITY OF ST. LOUIS)

Scott Wibbenmeyer, being first duly sworn on his oath, states:

My name is Scott Wibbenmeyer, and hereby declare on oath that I am of sound mind and lawful age; that I have prepared the foregoing *Surrebuttal Testimony*; and further, under the penalty of perjury, that the same is true and correct to the best of my knowledge and belief.



Scott Wibbenmeyer

Sworn to me this 13th day of December, 2023.