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MISSOURI PUBLIC SERVICE COMMISSION

FILE NO. EA-2019-0371

DIRECT TESTIMONY

OF

KEVIN D. ANDERS

ON

BEHALF OF

UNION ELECTRIC COMPANY

d/b/a Ameren Missouri

St. Louis, Missouri
September 3, 2019

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DIRECT TESTIMONY

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I. INTRODUCTION

Q. Please state your name and business address.

A. Kevin D. Anders, Union Electric Company d/b/a Ameren Missouri ("Ameren Missouri" or "Company"), One Ameren Plaza, 1901 Chouteau Avenue, St. Louis, Missouri 63103.

Q. What is your position with Ameren Missouri?

A. My position title is Vice President, Operations and Technical Services. My current role includes managing groups responsible for planning, design and operation of the Ameren Missouri distribution system, as well as for construction and project management of capital projects on the distribution system and in energy centers. Groups in my area of responsibility also perform maintenance of Ameren Missouri's 900 substations, on protection and control systems in its substations, and energy centers.

Q. Please describe your educational background and employment experience.

A. I hold a Bachelor of Science in Electrical Engineering from the Missouri University of Science and Technology. I also hold a Masters of Business Administration from the University of Missouri – St. Louis. I joined Ameren Union Electric Company in 1983 as an Engineer and have been employed in leadership roles in groups responsible for Protection and Control, Substation Maintenance, Engineering Design and Project

Management, and Distribution Operating. In 2012, I was promoted to Senior Director of Technical Services. In 2017, I was named Vice President of Operations and Technical Services.

II. PURPOSE OF TESTIMONY

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

A. The purpose of my direct testimony is to support the approval of Union Electric Company d/b/a Ameren Missouri's ("Ameren Missouri" or the "Company") application for three Certificates of Convenience and Necessity ("CCNs") for its Solar + Storage projects, initially at three locations: the Green City Renewable Energy Center ("Green City"), the Richwoods Renewable Energy Center ("Richwoods") and the Utica Renewable Energy Center ("Utica"). The Company may add additional locations to this project and, if so, will file additional CCN requests. My testimony describes the general approach to innovatively solve reliability issues on certain subtransmission circuits to benefit customers, and then provides details about each Project.

III. THE PROJECTS ARE INNOVATIVE RELIABILITY SOLUTIONS

Q. Please explain the difference between the Company's electric transmission, subtransmission, and distribution systems.

A. The transmission system supplies electricity to the subtransmission system through bulk supply transformers. The transmission voltages of 345 kilovolts ("kV"), 230-kV or 138-kV are reduced through the bulk supply transformers to subtransmission voltages, 69 kV and 34.5 kV. The subtransmission voltages are further stepped down to distribution voltages, 12 kV or 4 kV, through distribution substation transformers.

The subtransmission system includes both network and radial lines. A network system has multiple lines operating in parallel with more than one simultaneous path of energy flow to the customer or load. A radial system has a single source and one path for the energy flow to the load. A distribution substation that is fed by a single radial subtransmission line is commonly referred to as a "single supply substation."

The distribution system is normally operated as a radial system, which means an outage of the power source, or an outage of the distribution line between the power source and the customer, results in an interruption in electric service to the customer.

Q. What is the reliability concern for a single supply substation?

A. The main reliability concern for a single supply substation is that there is no secondary, or back up, to supply power during an outage. Power cannot be restored to the substation, and the homes, businesses, hospitals, and other customers it serves, until the issue has been corrected.

Q. Historically, how has the Company addressed reliability problems on its electric subtransmission system?

A. Historically, the Company, and the electric utility industry generally, addressed electric subtransmission system reliability problems by adding "reliability contingencies" via a "wires alternative." Wires alternatives provide backup power by adding a secondary supply (or circuit) or instituting a switching protocol.

Q. How are the Green City, Richwoods, and Utica projects innovative reliability solutions?

A. Each of the projects solves an electric subtransmission system reliability problem. More specifically, each of the projects solves the single supply substation reliability problem. While historically the Company would have only been able to solve those problems through wires alternative, due to the recent availability and cost competitiveness of solar generation combined with battery storage, this combination has become a potential option for solving such electric subtransmission system reliability problems.

IV. GREEN CITY PROJECT

Q. Please summarize the Green City project.

A. The Green City project is located near Green City, Missouri on Circuit GARD-74. Circuit GARD-74 is a radial, single supply running through Adair and Sullivan Counties. Schedule B of the Company's Application depicts the general layout and location of the Green City Project. The circuit terminates at the Green City Substation in Green City, Missouri. The feeder circuit serves nearly 1,000 customers and the Green City Substation serves 580 of those 1,000 customers. The feeder circuit has no reliability contingencies, such as a secondary supply or switching protocol to provide backup power. Therefore, if there is an outage of the circuit, power cannot be restored to customers until the issue is corrected.

Q. How many outages has the GARD-74 Circuit experienced over the last three years?

A. The GARD-74 Circuit experienced one outage in 2016, two outages in 2017, and two outages in 2018. The longest outage duration in 2017 was due to a broken insulator and lasted 4 hours and 18 minutes. This outage occurred in June when the estimated peak load was approximately 1.7 mega-watts ("MW"). This Solar + Storage project would have been able to supply customers with power for over 5 hours and they would only have experienced a short momentary outage.

Q. What alternatives did you evaluate to improve reliability for the GARD-74 Circuit?

A. We evaluated a traditional wires solution and a non-wires alternative to improve the reliability for this circuit. The traditional wires solution would involve installing a second supply from the Gardner Substation to the Green City Substation costing as much as $21 million and traveling 19 miles. Six of those 19 miles would be underground. We also evaluated a non-wires alternative solution — a Solar + Storage project.

Q. Describe the Green City Solar + Storage project.

A. The solar generating asset will consist of 10 MW (alternating current or "AC") of single-axis tracking photovoltaic panels. The battery storage component of the Project will consist of 2.5 MW of batteries with a duration of 4 hours. This project will utilize smart solar inverters, which are described below.

Q. Why was the non-wires alternative solution, a Solar + Storage solution, selected over the traditional wires solution?

A. The solar-plus-storage solution is the most cost effective method for meeting the subtransmission reliability needs of our customers on the GARD-74 Circuit. The cost for the Green City Project is $22.9 million with an American Association of Cost Engineers, or AACE, Class 3 cost estimate. An AACE Class 3 cost estimate has an expected accuracy range of -20% to +30%. I have attached a copy of the AACE cost estimate classification matrix to my testimony as Schedule KDA-D1.

The Green City Solar + Storage project provides other benefits as well, which are not available under the traditional wires solution. The project increases reliability by providing another source of energy if there is an outage on the primary source. During an outage, the circuit will be islanded, or segmented, from the bulk subtransmission system and the energy storage battery will form a microgrid within minutes. During the day, the solar array will provide energy needed for the circuit as well as charge the battery at the same time. When the solar array is unavailable, the energy storage battery can provide the energy. The Green City Project will supply the affected customers with energy for up to four hours during peak demand and ten hours during average demand.

Power quality will be maintained with the chosen smart inverters. Smart inverters are capable of providing voltage control as well as riding through voltage or frequency disturbances. The voltage control and ride-through functions help maintain system stability through minor grid events and disconnect the solar array completely during major grid events. Furthermore, the smart inverters can help immediately after a grid disturbance. By slowly increasing solar array output, the smart inverters will prevent voltage or frequency fluctuations while the grid is returning to normal operation.

The batteries will smooth intermittency to avoid voltage flicker frequently associated with renewable solar energy.

The Solar + Solar pairing will also improve scheduling for maintenance activities on the GARD-74 feeder during times of low demand. For example, during forecasted low-load conditions, Ameren Missouri may be able to schedule a planned outage and maintenance activity on the circuit limiting the number of customers affected.

V. RICHWOODS PROJECT

Q. Please summarize the Richwoods project.

A. This project is located near Richwoods, Missouri on Circuit ESTR-73. Circuit ESTR-73 is a radial, singular feed in Washington County. The feeder circuit terminates at the Richwoods Substation in Richwoods, Missouri. The feeder circuit serves more than 5,500 customers with the Richwoods Substation serving 615 of those 5,500 customers. As a circuit with no reliability contingencies, such as a secondary supply or switching protocol to provide backup power, if there is an outage, power cannot be restored until the cause is corrected. Additionally, the ESTR-73 circuit is a winter-peaking circuit, meaning the peak load occurs during the coldest months of the year, primarily due to customer resistive heating. During these peak load conditions, the feeder wires experience a physical sag due to the heat caused by high current. Excessive sag in the overhead line could cause the circuit to touch a tree branch or another object, potentially producing an outage.

Q. Describe the Richwoods Solar + Storage project.

A. The solar generating asset will consist of 10 MW AC of single-axis tracking photovoltaic panels. The battery storage component of the project will consist of 4 MW of batteries with a duration of 4 hours. This project will utilize smart solar inverters.

Q. What do you propose to improve reliability for the ESTR-73 circuit?

A. We evaluated two traditional wires solutions and a non-wires alternative to improve the reliability for this circuit. The first traditional wires solution would involve relocating and reconductoring the supply from the Valles Mines Substation to the Cadet

Substation costing as much as $6.1 million. This solution would alleviate the winter loading sag limitations on the circuit because the reconductored supply would be more capable to carry the peak load conditions the circuit currently experiences. However, it would not provide additional reliability in the case of the outage.

The second traditional wires solutions considered is the Cotter Creek Substation project that involves installing a new bulk substation north of Richwoods, Missouri, as well as installing a second supply from Cotter Creek to Richwoods. This solution would alleviate all winter peak switching and sag limitations by providing energy from another source and reducing the strain on the ESTR-73 circuit during peak conditions. It would also provide a contingency feeder to the Richwoods Substation in the event of an outage on the existing ESTR-73 feeder. The estimated cost for this solution is $68 million.

The non-wires alternative solution is a Solar + Storage project. The project associated with this circuit will supply the affected customers with energy for up to 3-1/2 hours during peak demand and ten hours during average demand. This increases reliability and resiliency through the renewable energy generated by the solar array and back-up energy from the energy storage batteries by providing another source of energy if there is an outage on the primary source. During an outage, the circuit will be islanded, or segmented, from the bulk subtransmission system and the energy storage battery will form a microgrid within minutes. During the day, the solar array will provide the bulk of the energy needed for the circuit as well as charge the battery at the same time. When the solar array is unavailable, the energy storage battery will provide the energy. During normal operations in winter peak load conditions, the Richwoods project will also serve to load shift and reduce the circuit sag limitation by limiting the energy required from the primary source.

The Richwoods project will maintain power quality with the chosen smart inverters. Smart inverters are capable of providing voltage control as well as riding through voltage or frequency disturbances. The voltage control and ride-through functions help maintain system stability through minor grid events and disconnect the solar array completely during major grid events. Furthermore, the smart inverters can help immediately after a grid disturbance. By slowly increasing solar array output, the smart inverters will prevent voltage or frequency fluctuations while the grid is returning to normal operation.

The energy storage batteries will provide intermittent renewable energy production smoothing to avoid voltage flicker frequently associated with renewable solar energy. The Solar + Storage pairing will also provide improved scheduling for maintenance activities during times of low demand. For example, during forecasted low-load conditions, Ameren Missouri may be able to schedule a planned outage and maintenance activity on the circuit, limiting the number of customers affected. The cost for the Richwoods Solar + Storage project is $23.4 million with an American Association of Cost Engineers, or AACE, Class 3 cost estimate. An AACE Class 3 cost estimate has an expected accuracy range of -20% to +30%.

Q. How many outages has the ESTR-72 circuit experienced over the last three years?

A. The ESTR-72 circuit experienced no outages in 2016, 2 outages in 2017, and 4 outages in 2018. The longest outage duration in 2018 was due to wire damage and lasted 4 hours and 12 minutes. This outage occurred in June and with an estimated summer load of 2.1 MW. The proposed Richwoods project would have been able to supply customers with power for over 7 hours, meaning they would only have experienced a short momentary outage.

VI. UTICA PROJECT

Q. Please summarize the Utica project.

A. This project is located near Utica, Missouri, on Circuit RAIL-72. Circuit RAIL-72 is a radial, single supply through Caldwell and Livingston Counties that terminates at the Utica Substation in Utica, Missouri. The feeder circuit serves approximately 1,800 customers and the Utica Substation serves 515 of those 1,800 customers. As a circuit with no reliability contingencies, such as a secondary supply or switching protocol to provide backup power, if there is an outage, power cannot be restored until the cause is corrected.

Q. Describe the Utica Solar + Storage project.

A. The solar generating asset will consist of 10 MW AC of single-axis tracking photovoltaic panels. The battery storage component of the project will consist of 2 MW of batteries with a duration of 4 hours. This project will utilize smart solar inverters, which are described below.

Q. What do you propose to improve reliability for the RAIL-72 circuit?

A. We evaluated a traditional wires solution and a non-wires alternative to improve the reliability for this circuit. The traditional solution involves installing a second supply circuit from the Polo Substation approximately 24.5 miles away. This traditional wires solution would cost as much as $13.9 million.

The non-wires alternative solution is a Solar + Storage project. The project will supply the affected customers with energy for up to five hours during peak demand and eleven hours during average demand. It increases reliability and resiliency through the renewable energy generated by the solar array and back-up energy from the energy storage batteries by providing another source of energy if there is an outage on the primary source. During an outage, the circuit will be islanded, or segmented, from the bulk subtransmission system and the energy storage battery will form a microgrid within minutes. During the day, the solar array will provide the energy needed for the circuit as well as charge the battery at the same time. When the solar array is unavailable, energy storage battery will provide the energy.

The Utica project will maintain power quality with the chosen smart inverters. Smart inverters are capable of providing voltage control as well as riding through voltage or frequency disturbances. The voltage control and ride-through functions help maintain system stability through minor grid events and disconnect the solar array completely during major grid events. Furthermore, the smart inverters can help immediately after a grid disturbance. By slowly increasing solar array output, the smart inverters will prevent voltage or frequency fluctuations while the grid is returning to normal operation.

The energy storage batteries will provide intermittent renewable energy production smoothing to avoid voltage flicker frequently associated with renewable solar energy. The solar-plus-storage pairing will also provide improved scheduling for maintenance activities during times of low demand. For example, during forecasted low-load conditions, Ameren Missouri may be able to schedule a planned outage and maintenance activity on the circuit, limiting the number of customers affected. The cost for this project is $21.9 million with an American Association of Cost Engineers, or AACE, Class 2 cost estimate. An AACE Class 3 cost estimate has an expected accuracy range of -20% to +30%.

Q. How many outages has the RAIL-72 circuit experienced over the last three years?

A. The RAIL-72 circuit experienced 1 outage in 2016, 3 outages in 2017, and 5 outages in 2018. The longest outage duration in 2017 was caused by wire damage from a storm and lasted 5 hours and 14 minutes. This outage occurred in October 2017 and with an estimated average load of 0.7 MW. This Solar + Storage project would have been able to supply customers with power for over 10 hours and they would only have experience a short momentary outage.

VII. TIMING AND RENEWABLE ENERGY CREDITS OF THE PROJECTS

Q. What are the proposed construction start and end dates for the projects?

A. The Green City, the Richwoods, and the Utica projects are expected to commence construction in 2020 and be placed in-service in 2020.

Q. Why weren't the traditional wires solution installed prior to now?

A. After an outage on any circuit, solutions to increase reliability and mitigate the most recent cause are evaluated. Ameren Missouri was unable to execute the traditional wires solution prior to now because other projects took higher priority to improve reliability for Ameren Missouri customers. Due to the timing of the renewable investment tax credit, standard solar installation processes, and commercially available energy storage technology, Ameren Missouri can show this non-wires alternative as an overall lower cost to customers than a traditional wires solution.

Q. Does the investment tax credit impact the timing for construction of the projects?

A. Yes, in order to qualify for the 30% investment tax credit, a solar project must begin construction before January 1, 2020. Generally, construction of a solar project will be considered as having begun if Ameren Missouri pays or incurs five percent or more of the total cost of the solar project before January 1, 2020. In addition, the solar project must be placed in service before January 1, 2024. Under the proposed timeframe for construction and completion of the Solar + Storage projects, Ameren Missouri can apply the 30% investment tax credit to the solar array and energy storage batteries and pass those tax credits through to our customers.

Q. Did Ameren Missouri consider installing the storage batteries without the solar generating assets?

A. Yes. Ameren Missouri considered installing the energy storage batteries by themselves. However, storage batteries are not eligible for the investment tax credit, unless they are charged from renewable energy, such as solar. The solar generating assets will provide energy during daytime outages while potentially charging the energy storage battery at the same time, depending on circuit loading. Pairing energy storage batteries with the solar asset allows a significant reduction in size of the batteries — by five times or more — without solar to provide the same reliability improvement. This size reduction reduces the projects' cost to the same amount or more than the Solar + Storage project cost.

Q. Will the solar generating assets for each of the projects produce renewable energy credits that will be used by Ameren Missouri to comply with the Missouri Renewable Energy Standard ("RES")?

A. Yes. While the solar generating assets are not specifically being built for RES compliance, the assets will produce renewable energy credits that will be used to comply with the RES.

Q. Has Ameren Missouri issued a Request for Proposals for the projects?

A. Yes. Ameren Missouri issued a request for proposal, and a contract development team representing a cross-function within Ameren evaluated the proposals and selected finalists. Ameren Missouri negotiated with the finalists and executed contracts with the winning qualified bidder.

VIII. PROJECT SITES

Q. Are there any environmental impacts or affects to wildlife at the three projects' sites?

A. Each site has undergone a Critical Issues Analysis. This Critical Issues Analysis considers wetlands, vegetation, wildlife issues as well as federal, state, and local land issues. As of the filing of this CCN Application, no adverse environmental or jurisdictional impacts have been identified.

After construction is completed, Ameren Missouri plans to utilize a pollinator-grass seed mix to promote bee and butterfly habitation while providing low-maintenance ground cover. The seed mix is a blend of grass and wildflowers with natural height growth limits of 18 to 24 inches. Through proper design of the panel arrays, the vegetation will only need maintenance once or twice a year due to its natural limited height. There are no other impacts to wildlife at this site.

IX. CONCLUSION

Q. Does this conclude your direct testimony?

A. Yes, it does.

COST ESTIMATE CLASSIFICATION MATRIX FOR THE PROCESS INDUSTRIES

The five estimate classes are presented in figure 1 in relationship to the identified characteristics. Only the level of project definition determines the estimate class. The other four characteristics are secondary characteristics that are generally correlated with the level of project definition, as discussed in the generic standard. The characteristics are typical for the process industries but may vary from application to application.

This matrix and guideline provide an estimate classification system that is specific to the process industries. Refer to the generic standard for a general matrix that is non-industry specific, or to other addendums for guidelines that will provide more detailed information for application in other specific industries. These will typically provide additional information, such as input deliverable checklists to allow meaningful categorization in those particular industries.

	Primary Characteristic	*Secondary Characteristic*			
ESTIMATE CLASS	**LEVEL OF PROJECT DEFINITION** Expressed as % of complete definition	**END USAGE** Typical purpose of estimate	**METHODOLOGY** Typical estimating method	**EXPECTED ACCURACY RANGE** Typical variation in low and high ranges [a]	**PREPARATION EFFORT** Typical degree of effort relative to least cost index of 1 [b]
Class 5	0% to 2%	Concept Screening	Capacity Factored, Parametric Models, Judgment, or Analogy	L: -20% to -50% H: +30% to +100%	1
Class 4	1% to 15%	Study or Feasibility	Equipment Factored or Parametric Models	L: -15% to -30% H: +20% to +50%	2 to 4
Class 3	10% to 40%	Budget, Authorization, or Control	Semi-Detailed Unit Costs with Assembly Level Line Items	L: -10% to -20% H: +10% to +30%	3 to 10
Class 2	30% to 70%	Control or Bid/ Tender	Detailed Unit Cost with Forced Detailed Take-Off	L: -5% to -15% H: +5% to +20%	4 to 20
Class 1	50% to 100%	Check Estimate or Bid/Tender	Detailed Unit Cost with Detailed Take-Off	L: -3% to -10% H: +3% to +15%	5 to 100

Notes: [a] The state of process technology and availability of applicable reference cost data affect the range markedly. The +/- value represents typical percentage variation of actual costs from the cost estimate after application of contingency (typically at a 50% level of confidence) for given scope.

[b] If the range index value of "1" represents 0.005% of project costs, then an index value of 100 represents 0.5%. Estimate preparation effort is highly dependent upon the size of the project and the quality of estimating data and tools.

Figure 1. – Cost Estimate Classification Matrix for Process Industries

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 Permission and Approval and Certificate of Convenience and Necessity Authorizing it to Construct Solar Generation Facility(ies)	)))))	File No. EA-2019-0371

AFFIDAVIT OF KEVIN D. ANDERS

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

Kevin D. Anders, being first duly sworn on his oath, states:

1. My name is Kevin D. Anders. I work in the City of St. Louis, Missouri, and I am employed by Union Electric Company d/b/a Ameren Missouri as Vice President, Operations and Technical Services.

2. Attached hereto and made a part hereof for all purposes is my Direct Testimony on behalf of Union Electric Company d/b/a Ameren Missouri consisting of 15 pages and Schedule(s) KD1 -D1, all of which have been prepared in written form for introduction into evidence in the above-referenced docket.

3. I hereby swear and affirm that my answers contained in the attached testimony to the questions therein propounded are true and correct.

Kevin D. Anders
Kevin D. Anders

Subscribed and sworn to before me this 30th day of August, 2019.

Cathleen A Dehne
Notary Public

My commission expires:

March 7, 2021

CATHLEEN A DEHNE
Notary Public – Notary Seal
St. Louis City – State of Missouri
Commission Number 17119727
My Commission Expires Mar 7, 2021