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FILE NO. EA-2019-0371

REVISED DIRECT TESTIMONY

OF

KEVIN D. ANDERS

ON

BEHALF OF

UNION ELECTRIC COMPANY

d/b/a Ameren Missouri

**St. Louis, Missouri
November, 2019**

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I. INTRODUCTION

1

2 **Q. Please state your name and business address.**

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

6 **Q. What is your position with Ameren Missouri?**

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

13 **Q. Please describe your educational background and employment**
14 **experience.**

15 A. I hold a Bachelor of Science in Electrical Engineering from the Missouri
16 University of Science and Technology. I also hold a Masters of Business Administration
17 from the University of Missouri – St. Louis. I joined Ameren Union Electric Company in
18 1983 as an Engineer and have been employed in leadership roles in groups responsible for
19 Protection and Control, Substation Maintenance, Engineering Design and Project

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

4 **II. PURPOSE OF TESTIMONY**

5 **Q. What is the purpose of your revised direct testimony in this**
6 **proceeding?**

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

16 **III. THE PROJECTS ARE INNOVATIVE RELIABILITY SOLUTIONS**

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

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

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

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

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

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

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

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

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

22 A. Each of the projects solves an electric subtransmission system reliability
23 problem. More specifically, each of the projects solves the single supply substation

1 reliability problem. While historically the Company would have only been able to solve
2 those problems through wires alternative, due to the recent availability and cost
3 competitiveness of solar generation combined with battery storage, this combination has
4 become a potential option for solving such electric subtransmission system reliability
5 problems.

6 IV. GREEN CITY PROJECT

7 Q. Please summarize the Green City project.

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

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

19 A. The GARD-74 Circuit experienced one outage in 2016, two outages in
20 2017, and two outages in 2018. The longest outage duration in 2017 was due to a broken
21 insulator and lasted 4 hours and 18 minutes. This outage occurred in June when the
22 estimated peak load was approximately 1.7 mega-watts ("MW"). This Solar + Storage

1 project would have been able to supply customers with power for over 5 hours and they
2 would only have experienced a short momentary outage.

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

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

10 **Q. Describe the Green City Solar + Storage project.**

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

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

17 A. The solar-plus-storage solution is the most cost effective method for
18 meeting the subtransmission reliability needs of our customers on the GARD-74 Circuit.
19 The cost for the Green City Project is \$22.7 million with an American Association of Cost
20 Engineers, or AACE, Class 1 cost estimate. An AACE Class 1 cost estimate has an
21 expected accuracy range of -10% to +10%. I have attached a copy of the AACE cost
22 estimate classification matrix to my testimony as Schedule KDA-RD1.

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

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

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

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

1 sag limitations on the circuit because the reconductored supply would be more capable to
2 carry the peak load conditions the circuit currently experiences. However, it would not
3 provide additional reliability in the case of the outage.

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

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

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

8 The energy storage batteries will provide intermittent renewable energy production
9 smoothing to avoid voltage flicker frequently associated with renewable solar energy. The
10 Solar + Storage pairing will also provide improved scheduling for maintenance activities
11 during times of low demand. For example, during forecasted low-load conditions, Ameren
12 Missouri may be able to schedule a planned outage and maintenance activity on the circuit,
13 limiting the number of customers affected. The cost for the Richwoods Solar + Storage
14 project is \$24.6 million with an American Association of Cost Engineers, or AACE, Class
15 1 cost estimate. An AACE Class 1 cost estimate has an expected accuracy range of -10%
16 to +10%.

17 **Q. How many outages has the ESTR-73 circuit experienced over the last**
18 **three years?**

19 A. The ESTR-73 circuit experienced 1 outage in 2016, 1 outage in 2017, and
20 4 outages in 2018. The longest outage duration in 2016 was due to an overhead failure and
21 lasted 7 hours and 45 minutes. This outage occurred in July and with an estimated summer
22 load of 2.1 MW. The proposed Richwoods project would have been able to supply

1 customers with power for over 7 hours, meaning they would only have experienced a short
2 momentary outage.

3 **VI. UTICA PROJECT**

4 **Q. Please summarize the Utica project.**

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

12 **Q. Describe the Utica Solar + Storage project.**

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

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

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

22 The non-wires alternative solution is a Solar + Storage project. The project will
23 supply the affected customers with energy for up to five hours during peak demand and

1 eleven hours during average demand. It increases reliability and resiliency through the
2 renewable energy generated by the solar array and back-up energy from the energy storage
3 batteries by providing another source of energy if there is an outage on the primary source.
4 During an outage, the circuit will be islanded, or segmented, from the bulk subtransmission
5 system and the energy storage battery will form a microgrid within minutes. During the
6 day, the solar array will provide the energy needed for the circuit as well as charge the
7 battery at the same time. When the solar array is unavailable, energy storage battery will
8 provide the energy.

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

16 The energy storage batteries will provide intermittent renewable energy production
17 smoothing to avoid voltage flicker frequently associated with renewable solar energy. The
18 solar-plus-storage pairing will also provide improved scheduling for maintenance activities
19 during times of low demand. For example, during forecasted low-load conditions, Ameren
20 Missouri may be able to schedule a planned outage and maintenance activity on the circuit,
21 limiting the number of customers affected. The cost for this project is \$21.7 million with
22 an American Association of Cost Engineers, or AACE, Class 1 cost estimate. An AACE
23 Class 1 cost estimate has an expected accuracy range of -10% to +10%.

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

3 A. The RAIL-72 circuit experienced 1 outage in 2016, 3 outages in 2017, and
4 5 outages in 2018. The longest outage duration in 2017 was caused by wire damage from
5 a storm and lasted 5 hours and 14 minutes. This outage occurred in October 2017 and with
6 an estimated average load of 0.7 MW. This Solar + Storage project would have been able
7 to supply customers with power for over 10 hours and they would only have experience a
8 short momentary outage.

9 **VII. TIMING AND RENEWABLE ENERGY CREDITS OF THE PROJECTS**

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

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

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

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

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

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

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

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

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

1

IX. CONCLUSION

2

Q. Does this conclude your revised direct testimony?

3

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.

ESTIMATE CLASS	Primary Characteristic	Secondary Characteristic			
	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

In the Matter of the Application of Union Electric)
Company d/b/a Ameren Missouri for Permission)
and Approval and Certificate of Convenience) File No. EA-2019-0371
and Necessity Authorizing it to Construct Solar)
Generation Facility(ies))

STATE OF MISSOURI)

CITY OF ST. LOUIS) ss

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.

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

Yves A. Best
Notary Public

GERI A. BEST
Notary Public - Notary Seal
State of Missouri
Commissioned for St. Louis County
My Commission Expires: February 15, 2022
Commission Number: 14839811