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Witness: Christopher Iselin
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MISSOURI PUBLIC SERVICE COMMISSION

FILE NO. ER-2014-0258

REBUTTAL TESTIMONY

OF

CHRISTOPHER ISELIN

ON

BEHALF OF

UNION ELECTRIC COMPANY
d/b/a Ameren Missouri

****Public Version****

St. Louis, Missouri
January, 2015

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I. INTRODUCTION

Q. Please state your name and business address.

A. My name is Christopher Iselin. My business address is One Ameren Plaza, 1901 Chouteau Avenue, St. Louis, Missouri 63103.

Q. By whom and in what capacity are you employed?

A. I am employed by Ameren Missouri as Senior Vice President of Power Operations and Energy Management.

Q. Please describe your employment history with Ameren Missouri.

A. I joined Union Electric Company d/b/a Ameren Missouri (the "Company" or "Ameren Missouri") in 1981 as an engineer at the Meramec Energy Center. Several years later, I transferred to the Labadie Energy Center ("Labadie") where I worked in positions of increasing responsibility including Engineering Supervisor, Operations Manager, Tech Support Manager and Maintenance Manager. In 1994, I was promoted to Director of Personnel, Safety & Training for the Company's non-nuclear generation group. In 2006, I became Vice President of Human Resources Business Services for Ameren Services Company. In 2008, I accepted a position with Ameren Energy Resources as Vice President of Generation Technical Support, ultimately assuming responsibility for plant operations. Four years later, I was promoted to Senior Vice President and President of Electric Energy, Inc. After Ameren Corporation divested its merchant generating companies, I was offered a position as Senior Vice President of Ameren's Corporate Operations Oversight function. In September of 2014, I started in my current position.

Q. Please describe your duties and responsibilities as Senior Vice President of Power Operations and Energy Management.

A. I am responsible for the safe, reliable, and efficient operation of approximately 9,000 megawatts of generation capacity at approximately two dozen separate sites including coal, natural gas, hydro and solar generation facilities. In addition, I am responsible for energy trading, the procurement of generating plant fuels and for the management of plant emissions, coal combustion byproducts and Ameren Missouri's renewable energy initiatives.

Q. Please describe your qualifications.

A. I hold a Bachelor of Science degree in mechanical engineering from the University of Missouri – Columbia, and recently completed the Massachusetts Institute of Technology Reactor Technology Program.

Q. What is the purpose of your rebuttal testimony?

A. The purpose of my testimony is to address the operational considerations to support Ameren Missouri utilizing a Must-Run commit status for the model used by the Midcontinent Independent System Operator, Inc. ("MISO") in dispatching our generating units. I also address the Missouri Public Service Commission Staff's ("Staff") proposed disallowance of costs arising from damage to collector plates that were delivered to the Labadie site for use in the Labadie electrostatic precipitator ("ESP") project, and the completion of the ESP and O'Fallon Energy Center projects.

II. COMMIT STATUS

Q. Sierra Club Witness Dr. Hausman has challenged the Company's Must-Run commit status for certain of its coal-fired generating resources that it offers into the MISO market. Do you agree with his claims that this commit status is uneconomic in that it increases overall production costs from Short-Run, least cost dispatch?

A. I disagree with Dr. Hausman's claim that Must-Run commit status is uneconomic, because he has not taken into account the operational costs associated with a commit status as Economic for base load generation. As explained by Company witness Jaime Haro, Economic status allows the MISO model to de-commit, or to issue a stop order for, dispatch of a generator based on a 24-hour market clearing period. The practical implication of this is the cycling of generation in and out of operation based only on locational marginal pricing considerations. This MISO dispatch algorithm does not factor in the costs and the other impact of cycling base load, coal-fired units. Those direct operational costs and other considerations are significant. Mr. Haro addresses this in detail in his rebuttal testimony.

Q. How does frequent cycling of coal-fired power plants increase operating costs?

A. Coal-fired units are primarily designed for base load (continuous) operation. Cycling these units on a frequent basis carries with it significant start-up costs, decreases unit availability, and shortens component life expectancies.

Q. What effect does frequent cycling of the base load, coal-fired units have on the Company's direct operational costs?

A. For a typical large, coal-fired unit, start-up costs include ignition fuel, which is either fuel oil or natural gas. Also, the primary fuel (coal) is burned prior to the dispatch of power for use or consumption. Even at the time the unit begins delivering load for dispatch, there are additional costs because the unit does not operate efficiently at start-up. These costs alone can vary between **____________________** depending on whether it is a warm start or a cold start.

Q. Are there other costs associated with frequent cycling?

A. Yes. Each time a power plant is cycled, its major and minor auxiliary components experience significant thermal and pressure stresses, which cause damage. This is most concerning for equipment that is subjected to high temperatures and pressures, and other mechanical forces. Over time and repeated cycles, this can result in failure of critical components. Under a frequent cycling dispatch model, component life can be expected to be shortened, driving up maintenance and capital costs. In addition, frequent cycling can be expected to result in more forced outages than would otherwise be the case; which reduces the margins that the unit can produce and ultimately increases net energy costs for customers.

Q. Can you illustrate this dynamic with some examples?

A. Yes. I will address two major components of a coal-fired unit: boilers and turbine generators.

Boilers have large, thick-walled steel headers, drums, and other components which are particularly susceptible to damage from the significant thermal and pressure stresses caused by shutdowns and start-ups. In cycling a unit off and on, these components are subject to temperature and pressure changes of as much as 1,000 degrees F and 3,600 psi, respectively. Components such as headers, waterwalls, and reheaters may see damage from cycling that result in increased tube leaks. Since damage from cycling is cumulative over time, as components age they will be even more susceptible to damage and have an even higher propensity to fail. As a conservative estimate, a tube leak outage can cost as much as $50,000 per day in repair costs.

Q. What are the effects of frequent cycling on turbine generators?

A. The turbine generator sets used by Ameren Missouri were designed to generate electricity primarily in a base load condition. Most turbine inner and outer casing pressure vessels are produced from castings of thick-walled steel. They also are susceptible to high thermal stresses generated during start-up, shutdown and load swing transients. With increased cycling of the equipment, components such as steam chests and casings will experience crack initiation and propagation in areas of high stress concentrations at an accelerated rate.

Q. What about the other features of the turbine generator?

A. Another area of concern is the turbine blades. Steam conditions during start-ups and shutdowns are greatly different than at full load. At full load, steam is highly pure and contains no water. During start-up or shutdown, on the other hand, steam quality is decreased and the steam contains impurities and water droplets. Impurities plate out on the turbine blades, and water droplets erode them, reducing both the unit's efficiency and capacity. Of even greater concern is the risk of corrosion deposits where the blades attach to the turbine rotor and/or erosion of the structural surfaces of the blades. Unless corrected, these conditions can put the turbine at risk of losing a blade while in operation.

Q. Does frequent cycling have any effect on generator field windings?

A. Yes, generator field windings "lock" into position at normal running speed. Frequent changes in speed cause the winding insulation to degrade at a more rapid rate. In addition, cycling operation causes expansion and contraction of the generator stator bars, resulting in degradation of the insulation on the bars. These known issues necessitate more frequent inspections. Current inspection intervals are approximately every ten (10) years. Frequent cycling would shorten the inspection intervals to approximately every five (5) years. This is significant, since generator inspections can cost more than $1,000,000 and take over four weeks to perform.

Q. Does frequent cycling have adverse effects on auxiliary plant equipment?

A. Yes. Increases in shutdowns and start-ups impact other plant components. Condensers and feedwater heaters are vulnerable to damage from thermal stresses. Feedwater heaters may experience more leaks and need more frequent repairs or need to be taken out of service and replaced, leading to plant thermal cycle inefficiencies and load limitations. Air heaters and precipitors may see more corrosion as gas temperatures drop below dew point conditions during start-up and shutdown.

Q. Are there any other considerations that the Missouri Public Service Commission ("Commission") should be aware of concerning the frequent cycling of base load, coal-fired units?

A. Yes. Start-ups have negative impacts on water and steam cycle chemistry and on air emissions. Nitrous Oxide, or NOx, emissions occur at a much higher rate during start-ups and at low loads. In addition, the majority of particulate, or opacity, issues occur during start-ups or shutdowns. Cycle chemistry control during start-ups is more difficult to achieve. Increased corrosion contaminants are then transported into the boiler and turbine components, leading to fouling by deposits of these contaminants. Turbine fouling is a leading cause of unit derates. Correcting this condition can cost several million dollars during a two to three month long outage period.

Q. Is Dr. Hausman correct that Ameren Missouri's use of a Must-Run commit status is uneconomic?

A. No. His analysis does not take into account important operational costs and limitations associated with frequent cycling of base load, coal-fired generation units. Consequently, his conclusion regarding the economics of Must Run versus Economic commit status is based on an incomplete and misleading analysis. Ameren Missouri's use of Must Run commit status has correctly taken these and other considerations into account.

III. LABADIE ESPs IN-SERVICE AND COLLECTOR PLATE DAMAGE

Q. Did the Company recently install new pollution control equipment at the Labadie Energy Center?

A. Yes. In response to the U.S. Environmental Protection Agency's mercury and air toxics standards to reduce particulate matter emissions, the Company installed new pollution control equipment, including ESPs, on Labadie Energy Center Units 1 and 2. An ESP is a filtration system that uses an induced electrostatic charge to remove fine particulate matter from the unit's emissions.

Q. What is the Staff's position regarding the Unit 2 ESP?

A. Staff's December 5, 2014 Revenue Requirement Cost of Service Report ("Staff Report") agrees that the installation of the ESP on Unit 2 was completed in August of 2014 and that the Unit 2 ESP is fully operational and used for service as of August 13, 2014.

Q. What is Staff's position regarding the Unit 1 ESP?

A. At the time the Staff Report was filed, the work on Labadie Unit 1 was not yet complete. That work was completed on December 13, 2014, and the Unit 1 ESP is now fully operational and used for service. We have provided Staff with information indicating that we have met the criteria we agreed upon with the Staff to determine if the ESP was in service. We have no reason to believe that Staff disagrees.

Q. Should the investment in the ESPs be included in rate base?

A. Yes. Installation of the ESPs was necessary to comply with federal Clean Air Act requirements, and those units are now fulfilling that purpose.

Q. Are there any other issues regarding the ESPs?

A. Yes. The Unit 2 ESP was installed at a total construction cost of approximately $89.38 million, but Staff is proposing a disallowance of approximately $408,048 related to an incident on May 29, 2013, regarding the collector plates for the Unit 2 ESPs.

Q. What happened to the collector plates on May 29, 2013?

A. On that date, 180 collector plates were being stored. The plates were shipped to the site in bundles of four to six. In accordance with the supplier's recommendation, the bundles were secured to one another with a bolted piece of flat iron on one end and a steel "staple" or connecting bracket on the other end. The entire set of plates was then secured to a vertical beam that was part of the storage rack. At approximately 12:00 noon, multiple bundles of the plates fell over. It appears a failure occurred at a connection between two bundles, likely because of strong winds. Wind gust speeds on this date reached 28 miles per hour. Ninety-four (94) plates were damaged beyond repair. No personnel were in the area at the time of the event.

Q. Does the Company agree with Staff's proposed disallowance for the May 29th incident?

A. No, it does not.

Q. Please explain why the Company disagrees with Staff's position on this issue.

A. The Company acted prudently at all times and in all respects. This accident was outside of the Company's control. Installation of the ESPs was challenging due to limited space, with hundreds of shipments of equipment being received, unloaded, and stored prior to installation. The Company provided the installation contractor, Alberici Constructors, with the collector plate handling and storage instructions provided by TECO Industries of Maryland, Inc., who is the product supplier. The plates were handled and stored according to these instructions.

Q. Are the plates easy to handle and to store?

A. No. Each plate is approximately 45 feet by 12.5 feet and weighs approximately 2,000 pounds. According to the handling and storage instructions provided by TECO Industries, any stress on a plate may cause permanent deformation or a kink in the material forming the plate, and the key to handling the plates is to avoid all undue stress.

Q. Did this incident delay completion of the project?

A. No. The 94 collector plates had to be replaced, but the overall project schedule was not impacted.

Q. Did Ameren Missouri incur any additional costs as a result of the incident?

A. Project contingency funds were used for the replacement plates, and the costs were within work order authorization limits. As a result of this incident, Ameren Missouri was liable for $391,000, the cost of the replacement plates, as this amount was below the original builder's risk insurance deductible. The Company determined it was prudent to decrease its builder's risk insurance deductible following this incident, resulting in a premium increase of $32,500. Alberici Constructors, the installation contractor, incurred an additional $125,000 for the purchase and fabrication of replacement racking. Ameren Missouri received a credit of $13,500 when the 94 damaged plates were salvaged, and this amount was credited against the Company's total construction costs.

Q. Did the Company take any steps to avoid a future, similar incident?

A. Yes. On the date of the incident, immediate action was taken to secure the area and to ensure the remaining 86 plates being stored were not damaged. Also, an additional risk assessment was performed. The supplier was consulted and various methods of plate storage improvements were evaluated. Additional bracing, in the form of steel framing, was developed to better secure the plates. Also, as new bundles were added to the rack, the bundle frames were tack welded to the rack frame, and, at the top of the bundles, the flat iron and "staples" were replaced with all-thread bolts. Additional vertical supports were welded onto the rack in various locations to provide additional support to the bundles. These changes were designed to mitigate the potential for any further incidents.

Q. What is the total dollar amount related to this incident?

A. The total amount related to this incident is $408,048. This amount should be added back to the total construction cost for this work.

IV. O'FALLON ENERGY CENTER

Q. Did the Company recently construct a new solar facility?

A. Yes. On April 8, 2014, the Commission approved Ameren Missouri's application for a certificate of public convenience and necessity to build a 5.7 MW direct current, photovoltaic solar facility. The facility is located in O'Fallon, Missouri, adjacent to the Company's existing Belleau substation and is the largest, investor-owned utility solar generator facility. It spans an area equivalent to approximately 19 football fields and contains almost 19,000 solar panels.

O'Fallon Energy Center

Q. Is construction of the O'Fallon solar facility complete?

A. Yes. The criteria we agreed upon with Staff regarding whether the center would be fully operational and used for service have been met.[1]

Q. Has the Company provided Staff with the information and documentation necessary in order for the Staff to evaluate whether the criteria have been satisfied?

A. Yes, the last of the necessary information and documentation was provided to the Staff on January 6, 2015.

Q. Does Staff agree that the criteria have been satisfied and that the facility is fully operational and used for service?

A. The Company is not aware of any Staff concerns, and therefore believes this facility has met all of the criteria and so should be considered in-service. However, given the timing of Staff Report, Staff was not able to testify to more than that its

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[1] The criteria are included with the Staff Report.

evaluation is on-going. (*See* Staff Report, p. 47). The Company anticipates Staff will agree the criteria have been met.

Q. Should the costs related to this solar facility be included in the Company's cost of service in this rate case proceeding?

A. Yes. As noted, the in-service criteria have been satisfied and the facility is fully operational and used for service.

V. SAFETY COMPONENT OF THE EIP-O PLAN

Q. Are you familiar with the portion of the Staff Report related to the Executive Incentive Plan for Officers ("EIP-O")?

A. Yes, I am.

Q. Do you agree with Staff's finding that the EIP-O currently in effect does not connect officer actions to safe, regulated, electric-only, Missouri operations?

A. No, I do not. As an officer of the Company responsible for the operation of all of our non-nuclear generating stations, safety of personnel and assets is one of the most important aspects of my job. I am personally involved in the design and implementation of safety programs, practices and policies. I sponsor the Power Operations Strategic Safety Steering Committee, a team comprised of the generating station directors and bargaining unit represented craft worker leaders, chartered with recommending ways to increase safety at our work sites. I am a member of the Corporate Safety Leadership Council, a group comprised of operating group officers and corporate safety support staff within Ameren, chartered with leading the corporate safety strategy and providing support, oversight, and resources to guide and improve Ameren's safety performance. I personally meet with each employee who experiences a recordable injury on the job, as well as that employee's co-workers and supervisor, for the purposes of understanding the thinking and behaviors that lead to injuries, ensuring that lessons to be learned are captured and shared and ensuring that our employees understand our expectations with regard to safe work. I attend many meetings of large work groups, where safety is almost always one of my topics of discussion. I believe the EIP-O connects officers to safe operations, and promotes their actions to drive better safety performance.

Q. **Does this conclude your rebuttal testimony?**

A. Yes, it does

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of Union Electric Company)
d/b/a Ameren Missouri's Tariffs to) Case No. ER-2014-0258
Increase Its Revenues for Electric Service.)

AFFIDAVIT OF CHRISTOPHER ISELIN

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

Christopher Iselin, being first duly sworn on his oath, states:

1. My name is Christopher Iselin. I work in the City of St. Louis, Missouri, and I am employed by Union Electric Company d/b/a Ameren Missouri as Senior Vice President Power Operations & Energy Management.

2. Attached hereto and made a part hereof for all purposes is my Rebuttal Testimony on behalf of Union Electric Company d/b/a Ameren Missouri consisting of 14 pages, and Schedule(s) N/A, 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.

C. A. Iselin
Christopher Iselin

Subscribed and sworn to before me this 16th day of January, 2015.

Beckie J. Eaves
Notary Public

My commission expires:
2-21-18

BECKIE J. EAVES
Notary Public - Notary Seal
State of Missouri
Commissioned for St. Louis City
My Commission Expires: February 21, 2018
Commission Number: 14938572