BEFORE THE CORPORATION COMMISSION OF OKLAHOMA

IN THE MATTER OF THE APPLICATION OF OKLAHOMA GAS AND ELECTRIC COMPANY FOR COMMISSION AUTHORIZATION OF A PLAN TO COMPLY WITH THE FEDERAL CLEAN AIR ACT AND COST RECOVERY; AND FOR APPROVAL OF THE MUSTANG MODERNIZATION AND COST RECOVERY	)))))))	CAUSE NO. PUD 201400229

REDACTED

Rebuttal Testimony

of

Gregory McAuley

on behalf of

Oklahoma Gas and Electric Company

January 26, 2015

Q. **Please state your name, your employer, position and business address.**

A. My name is Gregory McAuley. I am the Senior Manager of Transmission Operations for Oklahoma Gas and Electric Company ("OG&E" or "Company"). My business address is 321 N. Harvey, Oklahoma City, Oklahoma 73102.

Q. **Briefly summarize your education and professional background in the Electric Utility Industry.**

A. I hold a Bachelor of Science in Mechanical Engineering from the University of South Florida ("USF"), Tampa, FL. I began my electric utility career at Tampa Electric Company ("TECO") in January 1992 and worked in various capacities there until I joined OG&E in 2009. While at TECO, I had opportunities to work within many facets of the utility. My responsibilities included Power Plant Engineering and Maintenance, Commercial and Industrial Account management, Transmission and Distribution facilities construction, operations, and maintenance, and Environmental operations and testing. I've been with OG&E since January 2009 leading OG&E's Transmission Operations Control Center as Senior Manager of Transmission Operations.

Q. **What are your responsibilities as Senior Manager of Transmission Operations?**

A. I lead the group responsible for real time operation of OG&E's Bulk Electric System and interconnections, fulfilling its role as a Transmission Operator as regulated by the Federal Energy Regulatory Commission ("FERC"), the North American Electric Reliability Corporation ("NERC") and the Southwest Power Pool ("SPP"). The Transmission Operations team is tasked with monitoring and operating OG&E's transmission system that consists of over 5,000 circuit miles of transmission lines, over 160 transmission substations, and 28 generation facilities, 15 of which are wind farms. That work involves many day-to-day and real-time responsibilities as required by the NERC Reliability Standards and SPP Criteria. Those responsibilities include monitoring and controlling the real-time status of all elements of the OG&E transmission system for reliable operation. I am responsible to provide leadership and make certain the Transmission Operations team

has the tools and resources necessary to perform the critical functions for which it is responsible.

In addition to supervising our day-to-day operations, I represent OG&E at the SPP as Vice Chair of the Balancing Authority Operating Committee, which is responsible for reviewing and approving SPP's Balancing Authority Operating Protocols. I am also a member of the Operations Reliability Working Group ("ORWG") for the SPP. The ORWG implements, coordinates, and maintains criteria related to the reliable and secure operation of the bulk electric system operated by the members of the SPP.

Q. **Have you previously testified before this Commission?**

A. No.

Q. **What is the purpose of your testimony?**

A. My testimony will respond to the Responsive Testimony of Craig Roach, filed on behalf of the Public Utility Division Staff. Specifically, I will rebut Mr. Roach's belief that the Mustang site provides no special reliability benefits to OG&E and its customers. In fact, from my perspective as the transmission system operator, the Mustang site clearly provides unique reliability benefits to the transmission system, benefits that are important for both daily operations and system restoration situations.

Q. **Can you summarize what the OG&E Transmission Operation team does?**

A. Yes. OG&E is part of a huge, dynamic, high voltage grid stretching from the edge of the Rocky Mountains to the eastern seaboard. The system is in constant motion. The Transmission Operation team has System Operators, who are often referred to as the Air Traffic Controllers of the grid, constantly watching their portion of the system, running models, and staying ahead of whatever could go wrong. They monitor weather, load, generation, voltage, power flow, and system maintenance activities. My System Operators are required to ensure the system is operated such that it can reliably withstand the next contingency. In other words, the system must be operated such that it can withstand a system disturbance, such as an outage event, and remain within the defined System Operating Limits. This is commonly referred to as operating in an N-1 condition.

Since the grid is interconnected, managing voltage and power flow throughout OG&E's Transmission Operator Area is key to keeping the lights on in our service territory, and is also critical to reliable service in the 7 state SPP region and, indeed, the entire Eastern Interconnection.

Q. **How do you accomplish this very important job?**

A. OG&E's Transmission System Operators are NERC-Certified and a minimum of two and often more are scheduled to be on duty 24 hours a day, seven days a week. They are trained to monitor and operate the transmission system in a reliable manner, including, in particular, how to rapidly respond when conditions dictate to preserve the integrity of the system. We are greatly assisted in this job by a very sophisticated computer system known as a Supervisory Control and Data Acquisition ("SCADA") system. That system retrieves and displays data from generators, breakers, switches, transformers, transmission lines and other devices throughout the system. As changes to the configuration of the system occur or are required, the System Operators use the SCADA system to send signals to switching devices all across the 30,000 square miles of OG&E's area of direct responsibility. In this context, we pay particular attention to protective equipment, such as relaying systems, and Special Protection Systems that ensure our system will operate as it is designed in the event of a system disturbance. We also run models to predict the consequences of planned and unplanned transmission and generator outages. Those studies are used to put in place mitigation plans for everything from a simple equipment malfunction to a car hitting a transmission pole to an F-5 tornado destroying multiple transmission structures. We develop and define System Operating Limits that define the operating boundaries within which the Operators are required to run the system in order to prevent overloads, instability or unacceptable voltage deviations. And, we are responsible for developing and maintaining emergency operation procedures that can be used in a moment's notice, including procedures for total system blackouts and control center evacuations.

Q. **From the perspective of a System Operator, what role does the Mustang Facility play in the daily operations of the OG&E transmission system?**

A. As a source of dynamic reactive support to manage voltage, the Mustang Facility is very important. Also its proximity to our largest load center and the fact that it is connected to both the 138kV and 69kV systems on the west side of Oklahoma City make it uniquely important.

Q. **Why is it important to manage voltage?**

A. Voltage must be maintained within a rather narrow band. If voltage gets too high, utility infrastructure can be damaged causing customer outages and equipment replacement. It also can damage customer equipment such as televisions, computers, motors and other sensitive electrical devices. The real danger comes when voltage gets too low. Sagging voltage can turn into collapsing voltage in fractions of a second, which results in a blackout for our system and potentially other systems within the Eastern Interconnection.

Q. **What is voltage collapse?**

A. Voltage collapse is a condition in which the electromagnetic field of the power system can no longer be supported, thereby leading to a complete electrical failure, or blackout. Inadequate reactive support results in voltage drops, which results in reduced reactive power from any capacitors that are in service and line charging, which results in greater voltage drops leading to tripping of units, and ultimately voltage collapse. One of the difficult aspects in dealing with the risk of this kind of blackout is that it can happen so rapidly. When a system is stressed, as it is on very hot days, and we are importing large quantities of power across long transmission lines, voltage collapse can occur in fractions of a second as a result of a system disturbance. Dynamic sources such as generators are important tools in preventing this phenomenon. System Operators need enough of the right tools to do their job.

Q. **What tools do System Operators use to manage voltage?**

A. To maintain awareness of system conditions, System Operators use tools such as computer models, alarms in SCADA, and system maps. To respond as issues arise on the system,

they use other tools to manage voltage, such as capacitor banks, inductors, and generators like Mustang. The last tool they have available is customer load shedding, which requires blacking out certain areas of the system to prevent localized voltage issues from spreading to other areas of the system. This is used when it's the only hope to protect the rest of the system.

Q. **Give me an example of a typical voltage management situation and how it is typically handled?**

A. A common example would involve a low load winter day, with the wind blowing more than expected. Very limited local generation has been dispatched and voltage is running high. We make sure we have all of our inductors online and energized, reducing voltage as much as possible. We call the SPP and explain our situation. They issue an order for a local generator to start up even though it is economically out of merit because it can absorb the Volt Amps Reactive ("VAR") needed to lower the voltage to acceptable levels. Unfortunately, there are no quick start generators that provide significant voltage support in or near the Oklahoma City load pocket. If we cannot get any generators online quickly enough, we look for opportunities to reduce voltage by de-energizing certain transmission lines, reducing one reliability component to help with another. Ultimately, if we are unable to reduce voltage to acceptable levels, we would have no choice but to continue de-energizing transmission lines further reducing the system's ability to withstand contingencies until we have returned the system to acceptable operating limits.

Another example would involve a very hot day with very high customer demand. During those times, the voltage runs low in many parts of the system even though the generators, which are online are being pushed to their limits, and all capacitor banks are energized and in service. Then a major transmission line experiences a fault and trips out of service, limiting the amount of power we are able to import into the Oklahoma City area. The local generators online are unable to provide additional generation and/or VAR support and voltage drops even lower as more power is imported across the remaining transmission lines, further stressing the system. The Operators must then work with the SPP Reliability Coordinator to bring on a local generator as soon as possible for VAR

support and establish mitigation plans that often include shedding customer load until that local generation is available.

Quick start CTs at the Mustang site would be the perfect solution for each of these two common problems. They would be available very quickly both to absorb the VARs in the first example to bring the voltage down and to produce the necessary VARs in the second example to avoid shedding load.

Q. **What are VARs?**

A. VAR stands for Volt Amps Reactive and is an important but complicated component of the AC power system. VARs are known as "reactive power" and are necessary in maintaining voltage and facilitating the flow of power across a power system. In general, when one needs to raise voltage, VAR production is increased. When one needs to lower voltage, VAR production is decreased and/or VARs are absorbed.

Q **Do VARs have limitations?**

A. Yes. One of the characteristics of VARs relevant to this discussion is that VARs are very locational. They cannot travel long distances and do not transform from one voltage to another well.

Q. **How are VARs produced or absorbed?**

A. To balance the VARs on the system, we use static and dynamic reactive resources. Static resources are manually switched in and out of service as needed. Generators however are dynamic sources of VAR production and absorption. The reason they are important in responding to disturbances is that generators can automatically modify their VAR output in fractions of a second. It is imperative to have the capability to respond in fractions of a second to be effective in reacting to transient effects on the system and prevent a voltage disturbance from propagating across the system. To the extent local generators are removed from the system, the Operator has fewer options available to maintain system stability. OG&E needs both static resources and dynamic resources, such as generators like quick start CTs at the Mustang site, to control voltage on its system.

Q. **If the Mustang units are retired, how many MVARs of capability would be lost?**

A. The current generating units at Mustang are capable of producing 150 MVARs, which is a significant quantity of reactive power that the System Operators use to maintain transmission system reliability.

Q. **What amount of VAR support would you expect to receive if quick start CTs were installed at the Mustang site?**

A. Not only does the preservation of generation at the Mustang site provide significant reactive support, but installing quick start CTs at the Mustang site would provide 200 MVARs of reactive capability. Furthermore that capability would be available in ten minutes or less according to Witness Burch. The additional 50 MVAR capability will be important as load and imports continue to grow in the Oklahoma City area.

Q. **Why is it important for OG&E to have this amount of reactive support at the Mustang site when maintaining the reliability of the system?**

A. A system's ability to operate well within acceptable voltage limits is the best indicator of the sufficiency of the VAR support capability of that system. Our experience operating the system has proven that, even with the existing units at Mustang and the VAR support they provide, we sometimes struggle to maintain system voltage. Furthermore, as our system load continues to grow and more and more power is imported due to both the SPP Integrated Market and from production from an ever increasing number of remote wind facilities, even more local VAR support is going to be required. Mustang is also important because it has units connected to each of the 138kV and 69kV systems.

Q. **Why is it important to be on both the 138kV and 69kV systems?**

A. As stated earlier, VARs do not travel well and do not transform well. As a result, VARs need to be generated close to the load that needs the voltage support because their effectiveness decreases the farther they are from the source. Their effectiveness is also limited when they attempt to go through transformers, such as when going from the

138kV system to the 69kV system. By generating VARs near where they are needed, the VARs do not need to travel far and, by being generated on both the 138kV and 69kV systems, they don't need to go through a transformer to get to each system.

Q. [redacted]

A. [redacted]

Q. [redacted]

A. [redacted]

Q. **What types of critical loads are near the Mustang Power Plant?**

A. Although reliably serving all customer load is important to us, some of the most critical loads on the 69kV system are the Will Rogers World Airport, hospitals such as Integris Canadian Valley Regional Hospital and Deaconess Hospital, and large municipal water pumping stations serving Oklahoma City, Yukon, Bethany, and Warr Acres.

Q. **Why would quick start CTs enhance the Mustang site from the System Operators perspective?**

A. Replacing the existing steam units at Mustang with quick start combustion turbines would provide much more effective tools for restoring our system. As stated above, the old Mustang units take hours to start. If needed for system restoration, having quick start units available would reduce restoration times by between 9.5 and 22 hours. The same is true for voltage support. As we begin to encounter low or high voltage that wasn't predicted by our models, quick start units would prove invaluable to stay ahead of any potential system disturbances.

Q. **Would installing quick start generators at Mustang make it easier to bring wind resources to OKC?**

A. Yes, installing quick start CTs at Mustang not only replaces old and outdated equipment but provides a much more flexible state of the art tool to deal with the complexities of importing ever increasing wind generation from Western Oklahoma and other remote areas. The CTs will allow our system to more quickly respond to changing conditions inherent with variable generation resources.

Q. **Would purchasing Oklahoma Cogen provide incremental reliability benefits to the system?**

A. Oklahoma Cogen has not provided the data we requested regarding their ability to provide reliability benefits specifically in terms of VAR support. However, because Oklahoma Cogen is already on our system and modeled to provide approximately 30MVAR of reactive support, any VAR support it might offer is already there. Unless Oklahoma Cogen can show that it can provide more than 30MVAR of support it is not incremental to what we already have.

Q. **Do you have any concluding thoughts?**

A. Replacing the existing slow starting and less efficient Mustang units with new state of the art quick start combustion turbines will make our system inherently more reliable and help mitigate the risks associated with importing large quantities of power as has been

happening as a result of the new integrated market and the addition of large quantities of wind generation. In addition, the fact that they will be connected at both 138kV and 69kV, as well as, being located near our largest load center makes their placement at the Mustang site ideal from a system restoration perspective. I personally have more confidence we can bring the system back faster and maintain the required stability if we have the new CT's at Mustang.

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

A. Yes, it does.