BEFORE THE CORPORATION COMMISSION OF OKLAHOMA

IN THE MATTER OF THE APPLICATION OF	)	
OKLAHOMA GAS AND ELECTRIC COMPANY	)	
FOR AN ORDER OF THE COMMISSION	)	
AUTHORIZING APPLICANT TO MODIFY ITS	)	CAUSE NO. PUD 201700496
RATES, CHARGES, AND TARIFFS FOR RETAIL	)	
ELECTRIC SERVICE IN OKLAHOMA	)	

Redacted Direct Testimony

of

Gregory McAuley

on behalf of

Oklahoma Gas and Electric Company

January 16, 2018

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

A. My name is Gregory McAuley. I am the Director of RTO Policy & Development 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. In January 2009, I was hired by OG&E to be Senior Manager – Transmission Operations in OG&E's Transmission Operations Control Center. In July 2015, I took over the responsibilities for leading OG&E's efforts required by its membership in the Southwest Power Pool ("SPP"), OG&E's Regional Transmission Organization ("RTO").

Q. **What are your responsibilities as Director of RTO Policy & Development?**

A. I lead the group responsible for providing strategic oversight for OG&E's interactions with RTOs, particularly with the SPP. I represent OG&E in policy and RTO-related leadership positions, including the Member's Committee and the Markets & Operations Policy Committee at the SPP.

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

A. I led 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 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, 153 transmission substations, and 37 generation facilities, 24 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. My responsibilities included providing leadership and making certain the Transmission Operations team had 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 represented OG&E as 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.

I also represented OG&E as Vice Chair of the Balancing Authority Operating Committee, which is responsible for reviewing and approving SPP's Balancing Authority Operating Protocols and Emergency Operating Plan (EOP). The Balancing Authority Operating Protocols detail the elements that are required to support the operation of the SPP Balancing Authority, as addressed in Attachment AN of the SPP Open Access Transmission Tariff. These elements include items such as Tie Line Data, Frequency Measurement Data, Generation Data, Emergency Operating Data and Communications coordination.

The Emergency Operating Plan ("EOP") describes the fundamental concepts used to mitigate various types of system emergencies. It describes the authority and responsibility of the various functions within the SPP Balancing Authority ("BA") footprint as well as the requirements for ensuring that the plan is regularly reviewed and updated. The EOP addresses emergency operational subjects such as how to operate with neighboring entities, staffing levels for various emergencies, communication methods, fuel supply limitations and inventory, environmental constraints, load shedding and system restoration, among others.

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

A. Yes. I filed testimony in Cause No. PUD 201400229. I have also filed testimony before the Arkansas Public Service Commission in Docket No. 16-014-U.

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

A. My testimony will address OG&E's role in the SPP, why the Mustang site clearly provides unique reliability benefits to the transmission system, and why those benefits are important for both daily operations and system restoration situations. I also discuss how quick start CT generation at Mustang is a valuable tool for Transmission System Operators to ensure reliability of the grid, especially with the increased amount of variable wind resources in the SPP and Oklahoma in particular.

Q. **Please describe OG&E's role as a member of the SPP.**

A. As I mentioned above, OG&E is a member of the SPP RTO and a participant in SPP's Integrated Marketplace ("IM"). As a member of the SPP RTO, OG&E has placed its transmission facilities under the functional control of SPP and under the SPP Open Access Transmission Tariff ("OATT"). As such, OG&E is subject to and a participant in the stakeholder process implemented by SPP as approved by the Federal Energy Regulatory Commission ("FERC").

Q. **Please describe the stakeholder process at the SPP.**

A. OG&E actively participates in the stakeholder process to help ensure the most reliable, cost-effective outcomes for its customers. We do so by placing OG&E members on Working Groups, Task Forces and Committees within their respective areas of expertise to represent our customers at every step of the process. In my role as Director, RTO Policy & Development, I ensure that we have the right people in the right roles within the stakeholder process at SPP. I coordinate and conduct monthly group meetings with the OG&E members who represent us on the various working groups, task forces and committees and facilitate deliberations that confirm OG&E's position on issues. This coordination helps produce a consistent and deliberate approach to the various issues under consideration.

SPP describes its stakeholder process as follows:

> *SPP is a member-driven, relationship-based organization. We have in place a rigorous and transparent stakeholder process by which policy decisions are developed, informed, vetted and approved by diverse groups of stakeholders working together on behalf of everyone in our region. Hundreds of individuals representing our 95 member companies and other organizations serve on dozens of committees, working groups and task forces ("org groups", collectively) where decisions are made that fuel the continued evolution of SPP.* [1]

Q. **Can you comment on the various groups at the SPP that OG&E is involved in?**

A. Yes. While many OG&E members interact with various parts of SPP, as of December 2017, OG&E has approximately 25 members who are actively engaged in the SPP stakeholder process. For example, in the Economic Studies Working Group (ESWG), we have our Director- Resource Planning, Leon Howell, as a voting member. Leon's expertise in building and coordinating resource models is most useful in driving realistic regional models that ultimately lead to portfolios of transmission projects that contain only the amount of capital construction actually needed; to the extent the modeling suggests they will result in benefits to customers.

Once the ESWG approves a portfolio of projects, that portfolio is reviewed by the Transmission Working Group ("TWG") that is chaired by OG&E's Travis Hyde, Director – Transmission & Distribution Planning. The TWG is responsible, among other things, for coordinating with SPP staff in the development of the SPP Transmission Expansion Plan ("STEP").

The policies governing the SPP IM are developed and managed, in large part, within the Market Working Group ("MWG") whose job it is to develop and maintain the market protocols that define SPP-administered wholesale markets. OG&E's Shawn McBroom, Manager- Market Operations represents us in that working group.

[1] https://www.spp.org/about-us/stakeholder-process/

The Markets and Operations Policy Committee ("MOPC"), a full-representation group of which I am one of two OG&E voting members, ultimately votes to approve or reject recommendations from the various working groups. Finally, the Member's Committee, composed of representatives from various stakeholder sectors, votes on MOPC recommendations to the SPP's independent Board of Directors ("SPP BOD") who has ultimate authority in approving or rejecting projects. I was recently elected by the SPP BOD to the member's committee and serve as an Investor-Owned-Utility "(IOU") representative there.

In addition to the many working groups and task forces on which OG&E participates, we are also active in SPP BOD level committees such as the Finance Committee and Human Resources Committee to ensure SPP's cost activities line up with the customer focused approach we undertake at OGE.

Q. **Could you give an example of how OG&E's representation at the SPP benefits customers?**

A. A recent example of how we represent OG&E customers is the Potter-Tolk 345kV project. This was a 109-mile, 345kV line that was proposed in the panhandle of Texas. The estimate to build the line was $173 million, of which OG&E's customers would have been obligated to pay more than $18 million under the SPP's current cost-allocation methodology. After analyzing the proposal and listening to SPP Staff's presentation on the matter, we used our internal meeting time to discuss the issues. During those discussions, the various OG&E representatives concluded that the Potter-Tolk line was much too costly a solution and began the process of influencing the discussions within the stakeholder groups. After much debate within the ESWG and TWG, a recommendation to withdraw the project was presented to MOPC. In my role at MOPC, I spoke in favor of that recommendation and made the motion to approve the withdrawal of the project. That motion was approved and affirmed at the following SPP BOD meeting.

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

A. Yes. OG&E is a part of the Eastern Interconnection, a large, dynamic, high voltage grid stretching from the edge of the Rocky Mountains to the eastern seaboard. The

Transmission Operations 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. The System Operators are required to ensure the system is operated to meet current operating requirements and that it can reliably withstand the next contingency. In other words, the system must be operated so 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, while also critical to reliable service in the 14 state SPP region and the entire Eastern Interconnection.

Q. **How does OG&E accomplish this very important job?**

A. OG&E's Transmission System Operators are NERC-Certified and a minimum of two Operators, 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, rapidly responding 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. The SCADA 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, control center evacuations, and backup control center activation.

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. Having quick start generation at the existing Mustang Facility plays a very important role as a source of dynamic reactive support to manage voltage. It is particularly beneficial given that the plant is connected to both the 138kV and 69kV transmission systems. As discussed below, the old Mustang units have provided a significant source of reactive power that has been used to ensure transmission system reliability. With the retirement of those old Mustang units, that amount of reactive power around the Oklahoma City area will be lost unless OG&E replaces it. Quick start CTs not only replace that reactive power available to Transmission Operators, but those CTs will allow Transmission Operators to access even more reactive power and within a quicker response time.

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 the Company is 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 of reactive power, 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 to issues that arise on the system, System Operators 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 as a last resort in order to protect the rest of the system.

Q. **Please provide 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. OG&E makes sure it has all of its inductors online and energized, reducing voltage as much as possible. The Company calls the SPP and explains the situation. SPP then issues an order for a local generator to start up even though it is economically out of merit because it can absorb the VARs needed to lower the voltage to acceptable levels. If OG&E cannot get any generators online quickly enough, it looks for opportunities to reduce voltage by deenergizing certain transmission lines, reducing one reliability component to help with another. Ultimately, if the Company is unable to reduce voltage to acceptable levels, it would have no choice but to continue deenergizing transmission lines, further reducing the system's ability to withstand contingencies until the system has returned 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 on-line generators are being pushed to their limits and all capacitor banks are energized and in service. Should a major transmission line experience a fault and trip out of service, limiting the amount of power the Company is able to import into the Oklahoma City area, the local generators online would be unable to provide additional generation and/or VAR support and voltage would drop 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 more local generation online as soon as possible for VAR support and establish mitigation plans that often include shedding customer load until that local generation is available.

Q. **How does OG&E's Mustang Modernization Plan help System Operators handle each of these common voltage issues?**

A. 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. **When the Mustang units are retired, how many MVARs of capability will be lost?**

A. The old generating units at Mustang were capable of producing approximately 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 will you expect to receive when quick start CTs are installed at the Mustang site?**

A. Not only does the preservation of generation at the Mustang site provide significant reactive support, initial tests indicate that the quick start CTs at the Mustang site will provide approximately 175 MVARs of reactive capability. Furthermore, that capability will be available in ten minutes or less as further discussed by OG&E witness Burch.

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, the Company sometimes struggles to maintain system voltage. Furthermore, as 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 happens when going from the 138kV system to the 69kV system. By generating VARs near where they are needed, the VARs from Mustang do not need to travel far and, by being generated on both the 138kV and 69kV systems, they do not need to go through a transformer to get to each system.

Q. **If OG&E were to ever go into a blackout scenario, would Mustang be involved?**

A. Yes. OG&E is required by NERC regulations and good utility practice to have a system restoration plan that is reviewed and approved by the SPP Reliability Coordinator. This plan addresses instances when power has been lost throughout our system, and it outlines the steps the Company would take to put the system back together. [redacted] The system would then begin to synchronize and reconnect with our neighboring utilities. This can be a very long process ranging from a few hours to multiple days depending on how wide-spread the problem is and how much damage occurred as a result.

Q. [redacted]

A. [redacted]

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 will provide much more effective tools for restoring our system. As stated above, the old Mustang units took hours to start. If needed for system restoration, having quick start units available will reduce restoration times by between 2.25 and 22 hours, depending upon whether or not the older units were performing a hot restart or cold restart. The same is true for voltage support. In the event the Company encounters low or high voltage not predicted by the models, these quick start units will prove invaluable to stay ahead of any potential system disturbances.

Q. Does the installation of quick start generators at Mustang make it easier to facilitate the use of wind resources?

A. Yes, installing quick start CTs at Mustang not only replaces old and outdated equipment but also 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 (as well as the emerging intermittent solar energy infrastructure). The CTs will allow our system to more quickly respond to changing conditions inherent with variable generation resources.

Q. Has any third party recognized the value to the Mustang site with regard to the transmission system and the need to preserve the Mustang site?

A. Yes. Black & Veatch performed an evaluation of the Company's decision to retire the old Mustang units. In its report, Black & Veatch recognized the strategic value of the

Mustang site because of its close proximity to a major load center and its ability to provide key voltage support. Black & Veatch stated the following:

> Black & Veatch recognizes that the Mustang site also offers strategic value to OG&E's transmission systems operation. This is because of its close proximity to the major demand center(s) and its ability to provide dynamic reactive support to manage voltage. This value could potentially be increased if the existing gas fired steam turbine units were to be replaced with combustion turbines.
>
> Evaluation and quantification of this value is not part of this report; however, they do support the decision to continue to generate electricity at the Mustang site, especially when compared to using other sites (page 2-7).

Q. **Has the SPP conducted any analysis of the benefits of the new Mustang CTs?**

A. Yes. In 2017, the SPP completed a study that included an analysis of voltage stability within the BA. This 2017 Variable Generation Integration Study ("VIS") is discussed in greater detail by Company Witness Lanny Nickell, Vice President of Engineering for the SPP.

Q. **Does Witness Nickell believe that the installation of CTs at the Mustang site provides a benefit to the transmission system, the SPP, and customers?**

A. Yes. As testified by Mr. Nickell, not only does the SPP see a reliability benefit from new CTs in general, recent studies conducted by the SPP show how critical it is that the new CTs be located at the Mustang site. Mr. Nickell testifies about the new VIS study that analyzed the impact of the transmission system under various levels of wind generation. This study found that large levels of wind generation could lead to voltage collapse and system overloads in certain circumstances that could be prevented and alleviated by the CTs at Mustang. Mr. Nickell concluded that "the availability of generation at the Mustang site is critical to reliable system operations in the Oklahoma City area. The generation

OG&E has chosen, fast-start CTs, provides a valuable reliability tool to more quickly respond to system loading and voltages in the largest load center of Oklahoma." See Nickell Direct Testimony at page 8.

Q. **Did SPP conduct any other studies that validate the need for CTs at the Mustang site?**

A. Yes. As discussed by Mr. Nickell, SPP performed "contingency" analyses for the summer and winter peak conditions expected during 2018 and 2021. Based on these studies, SPP concluded that generation at Mustang is useful in preventing and reducing thermal overloads on area transmission facilities. Mr. Nickel testifies that, if generation facilities at Mustang are retired and not replaced, transmission overloads during first contingency conditions (N-1) would likely be observed in SPP's planning studies and require that the SPP direct construction of transmission upgrades.

Q. **Do you believe that these SPP studies and the testimony of Mr. Nickell validate OG&E's decision to construct CTs at its existing Mustang site?**

A. Yes. It confirms what I and OG&E management believed back in 2014 when OG&E made the decision to install CTs at Mustang – the site is critical from a reliability perspective, especially with quick start CTs that can be turned on fast and ramped up or down to respond to the growing amount of wind generation on the system.

Q. **How do OG&E's customers benefit from the Mustang CTs?**

A. As I stated previously, everything in the Eastern Interconnection is connected and disturbances in one area can be felt further away. It is like dropping a stone into a pond. There is significant disturbance in the water near where the stone enters and the ripples spread out from there. If OG&E is unable to contain the disturbance in the Oklahoma City area, it could cascade across the OG&E system and impact OG&E's entire service territory. Recall, in August 2003 there was a major blackout in the Northeast triggered by a single tree, the effects of which cascaded throughout the Northeast region.

Also, as testified by Mr. Nickell, customers benefit in general from Mustang CTs because they "improve the SPP's ability to maintain real-time system reliability while

enabling increased production from a growing supply of renewable resources, particularly those located west of the Oklahoma City area." Mr. Nickell also agrees with the possibility of system voltage problems propagating to other areas of the SPP. Finally, Mr. Nickell cites to the SPP IM benefits to all OG&E customers of having quick start CTs.

Q. **Would installing combined cycle ("CC") units at the Mustang site provide the same reliability benefits as CTs?**

A. No. First, based on the testimony of OG&E Witness Robert Burch, it is my understanding that it would not make sense to install CC units at the Mustang site. Second, from a system reliability perspective, CC units do not provide the same quick start response needed to address changing system conditions. OG&E has two large CC facilities near Oklahoma City (Redbud and McClain). It has very little CT capacity that can be quickly turned on and ramped up and down.

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 CTs will make OG&E's 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 the Mustang CTs will be connected at both 138kV and 69kV as well as being located near OG&E's largest load center makes their placement at the Mustang site ideal from a voltage management and system restoration perspective. I personally have more confidence we can bring the system back faster and maintain the required voltage stability if we have the new CTs at Mustang.

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

A. Yes, it does.