BEFORE THE ARKANSAS PUBLIC SERVICE COMMISSION

IN THE MATTER OF THE APPLICATION OF	)	
OKLAHOMA GAS AND ELECTRIC COMPANY	)	
SEEKING A DECLARATORY ORDER FINDING	)	DOCKET NO. 17-030-U
ITS MUSTANG GENERATION PLANT	)	
MODERNIZATION PLAN IS CONSISTENT	)	
WITH THE PUBLIC INTEREST	)	

Direct Testimony

of

Robert J. Burch

on behalf of

Oklahoma Gas and Electric Company

Q. **Would you please state your name and business address?**

A. My name is Robert J. Burch. My business address is 321 North Harvey, Oklahoma City, Oklahoma 73102.

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

A. I am employed by Oklahoma Gas and Electric Company ("OG&E" or "Company") as Director, Power Supply Services. My duties entail management of the generation engineering group and operation of OG&E renewable generation assets. I began my career with OG&E in 2012.

Q. **Would you please summarize your professional and educational background?**

A. I have been employed by four electric utility companies, a specialty chemicals refinery and a nationwide food manufacturing company over the last 32 years in a number of positions of responsibility including engineering, maintenance and operations and encompassing various management and executive assignments. Prior to OG&E, I was employed by Duke Energy/Cinergy in several positions, the last of which was Director of Engineering, Edwardsport Integrated Gasification Combined Cycle ("IGCC") generation station at Edwardsport, IN. The Edwardsport IGCC generation station is a $3.6 billion state of the art, advanced coal facility that entered commercial operation in 2013. My duties on the project included leading the effort to obtain all of the required environmental permits, technical management of 27 engineers engaged in the review of the plant engineering design, including a $130 million zero liquid discharge system to treat process wastewater and project management responsibilities for an 8 mile, $32 million private rail spur into the facility.

I received a Bachelor's of Science degree in Mechanical Engineering in 1985 from Rose-Hulman Institute of Technology.

Q. **Have you previously filed testimony before the Arkansas Public Service Commission ("Commission")?**

A. Yes. I filed testimony in Docket No. 16-014-U.

Q. **Have you previously testified before any other jurisdictions?**

A. Yes. I have filed testimony before the Oklahoma Corporation Commission in Cause No. PUD 201400229. I have also testified before the Indiana Utility Regulatory Commission related to the construction of Duke Energy's IGCC Plant at Edwardsport, Indiana.

Q. **What is the purpose of your Direct Testimony in this proceeding?**

A. I will address the operational and engineering reasons why OG&E decided to retire Mustang Units 1, 2, 3 and 4 and to replace those old steam generating units with modern gas combustion turbines ("CTs"). I also discuss why OG&E decided that the Mustang site was the ideal place to locate the new CTs. Finally, I discuss the contracting and construction processes, including an update on the cost and timing of the CT installation.

The Retiring Mustang Units

Q. **Please describe the old Mustang generating units.**

A. The Mustang Generating Facility is a natural gas fired plant, located on the west side of Oklahoma City in Oklahoma County, Oklahoma. It was originally constructed with four steam electric generating units that were designated as Mustang Units 1, 2, 3 and 4. The approximate total generating capability from this facility as constructed was 480 MW. Mustang Units 1 and 2 became operational in 1950 and 1951, respectively. Mustang Unit 3 became operational in 1955 and Mustang Unit 4 became operational in 1959. The Mustang plant is the oldest plant in OG&E's fleet.

Q. **What is the current age of the old Mustang units and what are the retirement plans for those units?**

A. Mustang Unit 1 had been in service 65 years and Mustang Unit 2 had seen 64 years of service when they were both retired in 2015. Mustang Unit 3 has been in service for 62 years and plans are for its retirement in 2017. Mustang Unit 4 has been in service for 58

years and plans also call for its retirement in 2017. OG&E's 2014 Integrated Resource Plan ("IRP") update addressed probable retirement dates for all the Mustang units based on recommendations from OG&E's Power Supply operations and engineering team.

Q. **What was the basis for retiring Mustang Units 1 and 2?**

A. OG&E concluded that it did not make sense to continue investing dollars in these very old units that were placed in service during the Truman Administration. Based on 2008 Energy Information Administration ("EIA") industry information, only 15 of over 400 operational units greater than 10 MW were older than Mustang Unit 1. Since that time, 7 of the 15 units have been retired. In 2012, OG&E engaged Burns and McDonnell, an independent engineering firm, to determine the "maximum" expected life of the Mustang Units and what level of investment in those old units would be required to reach those maximum service lives. Burns and McDonnell recommended OG&E undertake almost $17 million in capital investment on Mustang Unit 1 to get three more years life out of that unit. Also, Burns and McDonnell recommended another approximately $16 million in capital projects for Mustang Unit 2 in order to keep that unit operational until 2017. OG&E decided it made no sense to invest over $30 million for these two units in order to gain the potential of just a few more years of life. Plus, it would take a large part of the remaining life of those units to simply engineer, construct and install those capital projects.

Q. **Why was Mustang Unit 2 retired in 2015 after only 64 years of service instead of waiting until 2017?**

A. As sometimes happens with older units, a problem developed within the steam turbine. In this case, a water seal either partially or completely failed, allowing cold water to contact the turbine rotor. This caused the rotor to bow and experience severe vibration on hot start ups. Continued operation could have caused a failure. Costs necessary to open, inspect and make repairs to Mustang Unit 2 were deemed to be unjustified given the service factor (how often the unit runs) and the anticipated 2017 retirement date.

Q. **Would any of the projects recommended in the Burns and McDonnell site assessment study have detected, prevented or repaired this condition?**

A. No. None of the projects identified by Burns and McDonnell would have caused us to open, inspect and repair the turbine on Mustang Unit 2. In other words, if OG&E had spent approximately $16 million on Mustang Unit 2 as suggested by Burns and McDonnell, it still would have sustained the turbine problem that led to the need to retire Mustang Unit 2. OG&E therefore saved customers money by ceasing to invest in Mustang Unit 2, a very old unit that later suffered a serious component failure that required early retirement.

Q. **Does OG&E have any recent information that supplements the original recommendations from Burns and McDonnell?**

A. Yes. According to updated retirement information obtained from SNL in 2014,[1] many generating units have been retired well before reaching 65 years of service and the average and median retirement age of gas fired units across the U.S. is between 45-49 years old. As an example, from 2010 through 2012, Entergy retired 16 gas fired steam units with commercial operation dates from 1943 to 1965. The average service life of these units was 54 years. Very few gas fired units in the U.S. operate past 65 years of service.

Q. **What is the basis for the retirement dates for Mustang units 3 and 4?**

A. Mustang Units 3 and 4 are some of the oldest natural gas units in the entire country. Based upon similar class/size of units, there are only 6 out of 58 operating units with longer service lives than Mustang Unit 3. Mustang Unit 4 now has the longest service life of any unit of its size/class still in operation. Not only are Mustang Units 3 and 4 the oldest units in the OG&E fleet and some of the oldest units in the U.S., but OG&E had concerns about unit reliability, the risk of catastrophic failure and the need to invest significant dollars in outdated technology. After considering all factors, OG&E

[1] SNL Financial LC is a nationally recognized business intelligence company. The company focuses its research on business sectors including energy, banking, financial services, media and communication, insurance, and real estate. It collects, standardizes and disseminates all relevant corporate, energy, financial, market, and mergers and acquisition data using a wide variety of public sources such as SEC, FERC, EIA, etc. SNL has 24 offices worldwide.

management concluded that continuing to operate Mustang Units 3 and 4 beyond 2017 would require an increased level of investment to maintain reliability and safety. But, even with needed investment in key areas, the units are still at a greater risk of catastrophic failure as many key components are approaching or exceeding their design life.

Q. **Has OG&E attempted to quantify the costs of maintenance and capital investment that would be needed to give Mustang Units 3 and 4 the potential of reaching their maximum useful service life of 65 years?**

A. Yes. The 2012 Burns and McDonnell condition assessment study indicated that approximately $60 million in capital investment would be needed for Mustang Units 3 and 4 to reach their maximum useful life of 65 years. This would have made the retirement dates for Unit 3 and Unit 4 2021 and 2025, respectively. However, this study concentrates only on needed investment in a very few key areas such as the boiler, control systems, and main electrical transformers. The study does not address the need for investment in areas such as high energy piping, major headers, plant infrastructure, and large rotating equipment such as turbine generators and boiler feedwater pumps, all of which would add to the needed capital investment for continued operation. In fact, OG&E engaged Black & Veatch to perform an independent review of the Company's decision to retire the old Mustang units and they identified several additional projects totaling another $15.5 million at Mustang Units 3 and 4. Altogether, with the Burns and McDonnell and Black & Veatch projects that were identified, the total amount of investment for Mustang Units 3 and 4 was over $75 million.

Q. **What is OG&E's assessment of the reasonableness of making a minimum investment of approximately $75 million to keep Mustang Units 3 and 4 operational until they reach their maximum useful life?**

A. OG&E believes that making the approximately $75 million of investments identified in the Burns and McDonnell and Black & Veatch studies during the last few years of an assets useful life does not make sense for the Company or its customers. A good analogy

would be replacing the transmission in an old car immediately before deciding to take the car to the salvage yard.

Performing such work currently could also leave stranded investment and assets when the units are retired. Most of the investment items are sized and specifically designed for these units which are already the oldest or nearly the oldest in the nation, and as such, could not be reasonably expected to be reused or resold, thus reducing their value to near scrap value.

Q. **Does making the investment advocated by Burns and McDonnell and Black & Veatch guarantee a service life of 65 years?**

A. Absolutely not. Making the investment noted in the Burns and McDonnell report does not guarantee a 65 year service life. As I have said, the Burns and McDonnell report only focuses on certain areas and omits other critical areas. As stated above, the turbine condition on Mustang Unit 2 that led to its early retirement would not have been detected, prevented or repaired even if OG&E had executed all of the $16 million worth of projects identified in the Burns and McDonnell report for Mustang Unit 2.

Q. **What are some of the other critical components and areas of the plant not identified in the report that could fail unexpectedly?**

A. The Burns and McDonnell report did not address the risk of failure associated with critical high energy piping systems, such as superheater and reheat piping and headers that operate at high temperature and pressures. Another area not considered was the circulating water system that is comprised of very large underground piping that is subject to corrosion, cooling towers, large pumps and motor combinations, and condenser tubing. Burns and McDonnell also did not include investment in aging plant infrastructure including high and low voltage wiring and switchgear, which is becoming obsolete. The report also did not include large rotating equipment such as steam turbine/generator combinations and boiler feedwater pumps. The cost of replacing each of these components vary; however, each individual component could run in the millions of dollars with a total steam turbine replacement approaching as much as $70 million.

Q. **What additional areas of investment did Black and Veatch identify?**

A. Black & Veatch identified additional areas of investment that Burns and McDonnell did not cite in their report. These included condenser tubes (a portion of the circulating water system), large fans and motors (a portion of large rotating equipment), steam drums and high energy piping (a portion of the plant's pressure containing parts).

Q. **Are there specific components at risk of catastrophic failure with continued operation of Mustang Units 3 and 4?**

A. Yes. Certain components in units of this age are more susceptible to catastrophic failure. These components include items such as pressure containing parts, high voltage equipment and high speed rotating equipment. The risk of component failure due to age could also create a greater safety risk for our employees.

To illustrate our concern, OG&E experienced a cracked rotor in 2010 during the startup of Mustang Unit 4 that could have led to a catastrophic event. The operations staff noticed unusual turbine vibrations and investigated. The investigation revealed that the unit had a cracked low pressure turbine rotor. The machine was opened and resulted in the unit being offline for three months while repairs were made. The part for the repair was provided by the original equipment manufacturer, Siemens, out of surplus inventory. If not for the availability of this older rotor part, the repair cost would have been much greater and duration would have been up to 18 to 24 months. If the unit was actually brought online with the cracked rotor, it likely would have failed, rendering the machine inoperable and/or irreparable. This risk still exists with the other components for this machine due to age. And, as stated above, a new steam turbine could cost as much as $70 million.

Q. **Are there any reliability impacts that would result from the component failures described above?**

A. Yes. If failure were to occur in one of several major components such as the turbine, boiler headers or a generator step up transformer, the units could be offline for up to 2

years. Parts for units of this age are often non-existent, not supported by manufacturers or were produced by manufacturers that are no longer in business. This often requires that parts must be reverse engineered and specially made at a significant expense and delay.

Q. **How has the operation of the Mustang units changed over time?**

A. The Mustang units were originally designed for base-load type operation. They ran this way until the 1980s when the OG&E coal units became operational. As they have aged and as OG&E and others have obtained newer technologies elsewhere (*i.e.*, CC's), they have shifted their operating mode to more cyclic and intermittent duty. As an example, Mustang 4 from the late 1980s until 2006 operated in more of a mid-merit type mode (filling the gap between base load coal units and peaking units). More recently, in the SPP Energy Imbalance Services Market, they have experienced more seasonable/mid-merit operation. With the integration of the OG&E fleet into the Southwest Power Pool ("SPP") Integrated Marketplace ("IM"), the Mustang units, with their relatively higher cost, tend to operate in the 5% capacity factor ("CF") range and have seen greater amounts of daily cyclic and intermittent duty. The retiring Mustang units, because of their design, are not well suited for this cyclic mode of operation, which tends to shorten their remaining useful life and further increase the risk of unplanned outages. In 2014, after the start of the SPP IM, the Mustang units cycled 114 times. This is a 350% increase from the 33 times the units were cycled during the previous five years. This increase in cycling definitely contributed to OG&E's decision regarding the retirement of the old Mustang Units.

Q. **What are the effects of cycling units that were originally designed for baseload or load following operation?**

A. The effects of cycling are well known within the industry. Cycling units off and on creates significant thermal stresses on pressure components and rotating machinery. These increased stresses tend to reduce the lifecycle of such components and cause premature failures. This tendency increases with the age of the asset and the number of cycling events.

Q. **Are there any additional concerns that OG&E has with running these units past 2017?**

A. Yes. OG&E has concerns with the safety of its employees. While OG&E exercises the appropriate measures of safety with all its generating units and can minimize exposure to its employees through access control, the Company cannot eliminate all risks to its employees. Units of this age are subject to pressure part failures and failures of high speed rotating equipment, which could place employees in harm's way. Inspection and maintenance practices can help identify areas of concern, but it is not possible to fully inspect every component and have complete certainty that a catastrophic event cannot occur on these very old units.

Q. **Is the decision to retire the remaining Mustang units by year-end 2017 consistent with OG&E's past approach as it relates to the retirement age of gas fired steam units**?

A. Yes. OG&E has retired a number of gas fired steam units over its 115 year history. Since the early 1980s, OG&E has retired several gas-fired units including Muskogee unit 3, the Arbuckle Plant, the Osage Plant, and the Belle Isle plant. The average retirement of these OG&E gas fired steam plants came after 51 years of service.

Q. **Has OG&E conducted any additional studies to corroborate its decision to retire Mustang**?

A. Yes. As discussed above, OG&E retained the services of Black & Veatch to review the decision to retire the Mustang Plant by the end of 2017.

Q. **Did Black & Veatch concur that OG&E's decision was prudent?**

A. Yes. The September 2016 Report issued by Black & Veatch states that "retiring the existing [Mustang] units was a prudent decision."

Q. **What did Black & Veatch rely on to make a prudency determination**?

A. Black & Veatch evaluated OG&E's decision to retire the Mustang plant by the end of 2017 and the information that supported that decision, including OG&E testimony filed in other regulatory proceedings, the 2012 Burns and McDonnell condition assessment report and their experience in the industry regarding similar retirement decisions. For specific supporting information please refer to the direct testimony of Phillip Webster.

Q. **The 2012 Burns & McDonnell report indicated that a certain level of investment through capital projects could extend the life of the plant to 65 years of age. Does Black & Veatch disagree with the Burns and McDonnell study?**

A. No. Black & Veatch believes the projects recommended in the 2012 Burns and McDonnell Condition Assessment Study were technically sound and could have been implemented if the goal was to reach 65 years of service for each unit.

Q. **Did Black & Veatch make any further recommendations on additional investment at Mustang?**

A. Yes. Based on their experience, Black & Veatch suggested a limited number of additional projects that should have been considered given the age of the units. As stated above, Black & Veatch identified approximately $15.5 million in additional projects needed at Mustang units 3 and 4.

Q. **What was the basis for Black & Veatch's conclusion that OG&E's decision to retire the old Mustang units was prudent?**

A. Black & Veatch concluded that OG&E's decision to retire the Mustang units in 2017 was prudent based on the required investment and continuing and potentially increasing Operations and Maintenance costs to keep the units in service until age 65, as compared to the experienced and expected low capacity factors for the units moving forward. The costs that would have to be expended are not justified by the little amount of energy the retiring Mustang units would produce, especially when there is a cost effective option available to the Company.

Q. **Did Black & Veatch identify any additional risks for increased costs associated with continuing to operate the old Mustang units?**

A. Yes. Black & Veatch found that the various Mustang projects could trigger a New Source Review ("NSR") analysis. One outcome of an NSR review could be a requirement to install air pollution control equipment using the Best Available Control Technology ("BACT") for each pollutant exceeding national ambient air quality standards ("NAAQS"). In the case of Mustang, BACT could require the installation of Selective Catalytic Reduction Systems ("SCR")[2].

Q. **Why did OG&E enlist Black & Veatch now to study and comment on OG&E's 2014 decision to retire Mustang in 2017?**

A. OG&E was criticized in another regulatory proceeding for not performing an engineering study to support its decision to retire Mustang in 2017. While the decision in 2014 was made based on the opinion of the Company's technical experts, years of successful operating experience and an excellent track record, the Company determined that an independent third party study was necessary in order to respond to critics. OG&E remains confident that retiring Mustang in 2017 is the right decision and believes that Black & Veatch's conclusions validate that decision.

The Mustang Modernization Plan

Q. **Please describe the type of units OG&E intends to install at the Mustang site.**

A. The CTs being installed at Mustang are of a class known as Aero-derivative and can best be described as resembling a jet engine on a commercial aircraft. This class of CT is typically smaller and more flexible than larger frame class combustion turbines. Aero-derivative CTs have the ability to be turned on and off quickly. This allows them to supply power during peak to serve unscheduled demand and to supply ancillary services to the grid, such as operating reserves. These units will deliver better reliability,

[2] *Evaluation Report: Mustang Power Plant Retirement Consideration* September 20, 2016 by Black & Veatch, pages 3-10.

improved efficiency, better load response, improved operational flexibility and lower emission rates.

Q. **How do CTs produce electricity?**

A. Ambient air is introduced to the unit through a compressor that brings it to a higher pressure. Energy is then added by spraying fuel (natural gas) into the air and igniting it so the combustion generates a high pressure, high temperature flow that expands through a turbine. The turbine is connected by a shaft to a generator, which produces electricity.

Q. **Do CTs make up a large percentage of OG&E's capacity?**

A. No. Right now, only a very small percentage of OG&E's generating capacity represents quick start CTs. The Company only has 151 MW of such CTs in its overall generation fleet of nearly 7000 MW.

Q. **Has OG&E selected the specific units to be installed at Mustang?**

A. Yes. By virtue of a competitive bidding process, OG&E selected and is installing seven Siemens Trent 60 units at the Mustang Plant site, with a nameplate rating of 66 MWs each.

Q. **Does OG&E expect the Mustang CTs to be dispatched differently in the SPP IM than the retiring Mustang steam units?**

A. Yes. As an example, the Company's Horseshoe Lake Units 9 and 10, which are also aero-derivative CTs similar to the new Mustang CTs, have been called to start 1,486 times from January 1, 2014 through December 2016, the last full year of data. This equates to an average of approximately 248 starts per unit per year. These same units averaged 63 starts per year over the previous three years (2011 – 2013) before the start of the SPP IM. The new Mustang CTs will increase the asset diversity of the OG&E fleet by increasing CT capability from approximately 151 MW to approximately 613 MW. Also, none of the CTs currently in the OG&E generation fleet will be as nimble and quick-starting as the new Mustang CTs, which will have the fastest start-up times and ramp rates of any of the OG&E's generating units. For example, Horseshoe Lake Units 9

and 10 (which constitutes approximately 90 MWs of CTs in the OG&E fleet) will take twice as long as the new Mustang CTs to start up and achieve full load.

Q. **What characteristics of the new CTs make them more likely to be dispatched in the SPP IM?**

A. The capability of a generating unit to respond to load is indicated by three measures: start up time, ramp rate and turndown. Startup time indicates the length of time required to take the unit from an offline, cold state to full load operationally. Ramp rate indicates the rate at which the unit can change load once in service, measured in megawatts per minute. Turndown indicates the lowest stable load the unit can achieve before it must be removed from service. All of these performance characteristics offer value to the system in the ability to operationally respond to load needs. The CTs being installed at Mustang typically can provide a startup time of 10 minutes compared to a minimum of 10 hours for the old Mustang units. The comparative ramp rate performance for the replacement CTs is 11 MW/minute versus an average of 2.0 MW/minute for the retiring Mustang units. Each CT being installed at Mustang can be turned down to 20.2 MWs. In all of these cases, the combustion turbine technology offers significantly improved performance on load response and flexibility. These units are designed to start multiple times per day if needed to match the peaks in the market and respond to unexpected and unscheduled changes in demand that can occur. In addition, the faster response offers significantly improved ability to respond to the variability of intermittent resources such as wind and solar.

Q. **How does quick start ability in OG&E's fleet benefit the customer?**

A. As previously mentioned, quick start units are more flexible in the role of supporting system needs on short notice. Those needs could be in response to upset conditions on the transmission system or variability of renewable resources, and providing system reliability benefits.

The Mustang CTs are more flexible than a frame type CT and can turn down their output to approximately 20.2 MWs. By contrast a typical 100 MW frame unit can only operate stably at approximately 50 MWs. The value of this flexibility lies in the fact that

if load increases, these units are already on line and able to meet the new demand as opposed to needing to start a cold unit. This is in comparison to a frame unit that could have already been decommitted and not on line to support the increase in demand.

Q. **Why did OG&E not select a combined cycle unit to replace the retired units at Mustang?**

A. A Combined Cycle unit would be significantly limited operationally at the Mustang site because of the use of netting under the existing permit. Because the Company permitted the new generation through the netting process, we were limited to a 33% capacity factor through our air permit. This range of allowable operating hours suits units that are primarily in a peaking mode like the new Mustang CTs, which are expected to come on during peak times, run a few hours and be turned off. By contrast, a Combined Cycle unit is expected to come on and run a longer, continuous stretch. A Combined Cycle unit at Mustang would be limited in its permitted capacity factor and unavailable to run enough throughout the year, thus limiting its value to customers.

Q. **What is OG&E's estimated installed cost per kW for the Mustang CTs?**

A. OG&E's total project cost is approximately $768/kW based on the expected project cost of $355 Million (exclusive of AFUDC and ad valorem taxes) and nameplate CT output.

Q. **Why are the actual costs at Mustang lower than originally estimated?**

A. As discussed below, OG&E was able to re-use certain high value portions of the infrastructure at the existing Mustang site. In addition, as discussed below, OG&E utilized a contracting strategy and a robust competitive bidding process to reduce the overall project cost.

The Value of the Mustang Site

Q. **Why did OG&E select the Mustang site to locate new generating units?**

A. The Mustang site offers several clear and distinct advantages to OG&E. Those advantages include being in close proximity to OG&E's largest load center, having an

established infrastructure in place, having a trained and experienced workforce and having existing environmental permits and strong community support.

Q. **Please explain the advantages the existing Mustang site has with respect to its proximity to the load center.**

A. Maintaining generation at this location is very important to OG&E system operations. The Mustang site already has an existing, robust high voltage transmission system in place consisting of nine different transmission lines on two separate voltage systems. This results in better reliability of the transmission grid as opposed to locating the new generation at a more remote location. Generation close to the load source reduces line losses, reduces line congestion and cost, supports voltage control, and facilitates our system restoration plan. Witnesses McAuley and Nickell discuss the reliability benefits of CTs at the Mustang site.

Q. **What are some of the other operational advantages of the existing Mustang site?**

A. The Mustang site already has the overall infrastructure needed to support a generating facility, *i.e.*, secure property, existing roads; facilities to support maintenance & operation, water supply/water rights, as well as existing transmission infrastructure. This avoids the significant expense and need to develop a completely new site and infrastructure. Additionally, the Mustang site is currently staffed with a highly skilled/trained workforce.

Q. **Are there any quantifiable benefits of utilizing the Mustang site for the new CTs?**

A. Yes. The value of re-using the Mustang site, as compared to a new typical Oklahoma greenfield site, has conservatively been estimated by Burns and McDonnell at approximately $45 Million and is detailed in Exhibit RJB-1. Major components of the project that do not need to be recreated include:

1. Switchyard facilities - $8 Million
2. Transmission facilities, including any interconnect studies and associated transmission lines and transmission system upgrades - $26 Million
3. Water utilities into the site - $10 Million

This value is conservative in the fact that it does not fully quantify the value of the robust transmission system that is comprised of nine (9) outgoing transmission lines on two (2) voltage systems. The robustness of the transmission system at Mustang provides customer value in maintaining system reliability and flexibility as well as supporting a more expedient system restoration effort, if required. These benefits of a robust transmission system at Mustang are more fully explained in the testimony of OG&E Witness McAuley. For comparative purposes, a generic greenfield site was estimated by Burns and McDonnell as having a single transmission line exiting the facility on one system voltage which is the bare minimum required for site operations. Those costs would be required for any greenfield site. Another reason that this estimate is conservatively low is that Burns and McDonnell used the lower end of its cost estimate for SPP Network Upgrades ($10 million) instead of the higher end of the range ($40 million).

Q. **Did Burns and McDonnell's estimate of cost savings from using the Mustang site include the cost of comparable real property?**

A. No. It is difficult to develop a cost estimate for such a unique piece of property. The property is unique because it is difficult, if not impossible, to locate a similarly sized parcel of land located as close to a major load center that has the ability to be permitted as a power plant. Also, complicating that search would be the difficulty in finding a site that has enjoyed a long history of public support from and with the local residents, businesses and communities.

Nevertheless, to illustrate the potential customer savings from re-using the land at the Mustang site, OG&E reviewed public records of 20 parcels sold within a 10 mile radius of the Mustang site since 2014. While it was difficult to find comparable pieces of land, the weighted average cost per acre of the 20 parcels examined was about $43,000/acre. Extending that price to the 111 acres of the Mustang site would yield a conservative value of almost $5 Million. Adding this to the cost savings identified by Burns and McDonnell, OG&E's utilization of the existing Mustang site conservatively saved the Company, and its customers, nearly $50 million.

Q. **Are there any other benefits to the Mustang site?**

A. Yes, as testified by Witness Donald Rowlett, OG&E has permitted the new CTs through a process known as netting. OG&E had the ability to utilize emission "netting" to combine the retirements of the old units with the construction of the new units and obtain a permit without a "net" increase in emissions. This emission "netting" allows OG&E to maximize the Mustang site for newer, more efficient generation. Emissions netting simplifies the process to obtain a permit from the ODEQ by allowing the emissions from the new units to be offset by that of the agency-approved and permitted historic operations ("emission window") thereby creating no new environmental impact to the air shed that would require further evaluation by the ODEQ.

Absent netting, incremental new generation that is not authorized through a netting process would likely have to obtain a major source construction permit under the Clean Air Act. The additional time, expense and uncertainty associated with a major source construction permit could affect the viability of the project at the Mustang site.

The netting process brought with it certainty in obtaining the necessary permits to construct the new units. With tightening environmental regulations, the ability to obtain a brand new permit near a major load center with other industries contributing to the air shed is uncertain.

Q. **What other benefits does the Mustang site offer?**

A. The Mustang site is served by nine different transmission lines operating on two separate voltages. This robust system provides for a variety of benefits and system flexibility. The cost to recreate this would be well into the millions of dollars; however, OG&E has not estimated the value of the flexibility or the cost to recreate on another site. OG&E is unaware of any other site in or near any of its major load centers that contains this advantage. Finally, the Mustang facility currently has a highly trained and capable workforce. While the value of that existing workforce is difficult to quantify, there is no doubt that our trained employees working at the Mustang site have enormous value.

The Mustang Contracting and Construction Process

Q. **How did the Company approach the process of buying equipment and constructing the CTs at the Mustang site?**

A. OG&E has issued approximately 39 different competitive bid packages for equipment, materials and services, including labor. Each of these packages was sent to an average of three to four bidders, in some cases more. Each package was awarded on price and value, with several of the major packages being evaluated using Kepner-Tregoe Decision Analysis Techniques ("KT Analysis"). To date, competitive bidding for material, equipment and services has resulted in a $2.3 million savings as compared to overall budget.

Q. **Did OG&E enter into an Engineering, Procurement and Construction ("EPC") contract with fixed price terms?**

A. No. OG&E believed there were greater savings by not entering into such a contract and in fact forecasts $45 million in savings.

Q. **Please explain the decision to not use an EPC contract saved customers money.**

A. With an EPC, fixed price contract, the ECP contractor submits a price to cover all aspects of the work necessary to accomplish the agreed upon scope. EPC contractors build contingency costs into the contract's fixed price in order to mitigate project risks for which the EPC contractor would be responsible. Essentially, the EPC contractor takes on the risk of various cost increases and OG&E is largely insulated from that risk. However, if the EPC contractor realizes savings or reduced costs, the benefit of those cost reductions goes to the EPC contractor. Plus, an EPC contract is still subject to changes in scope and to the negotiated terms and conditions. It is rare that an EPC contract is fully executed without changes to the negotiated price.

For the Mustang CTs, OG&E believed that it had an opportunity to reduce the costs and was willing to take on the cost risks itself. Therefore, OG&E decided to directly contract for the engineering, procurement and construction and merely use a construction manager to help oversee the project. As a result of this decision, OG&E was

able to manage the construction process without an EPC Contractor, which to date, has resulted in a significant overall cost savings.

Q. **Please elaborate on the benefits of using OG&E's direct contracting approach instead of the EPC contracting approach.**

A. OG&E's contracting strategy, which includes the use of competitive bidding, has contributed to an estimated $45 million in savings over the original project budget by controlling the competitive procurement process and keeping any achieved savings. Using this approach for the Mustang project allowed OG&E to control contingency costs. If a risk associated with the project does not happen, OG&E customers see the direct savings through an overall reduction in the project's cost rather than increased profits for the EPC contractor. OG&E's approach also eliminated any EPC contractor fee and overhead charges.

Q. **Why was this project conducive for OG&E's contracting strategy?**

A. On the Mustang project, OG&E determined that the complexity and the risk of installing seven identical units did not warrant the additional costs that an EPC contract would require. OG&E believed it could manage the project to maximize the amount of savings and allow OG&E customers to benefit from any savings realized instead of the EPC contractor. Other factors that influenced that decision included:

1. OG&E has been fortunate to have attracted employees with significant experience in successfully managing similarly scoped projects. OG&E can, and has, leveraged that experience to utilize contracting strategies that result in cost savings for customers.
2. The Mustang Site has ample room on the property, which significantly reduces risks associated with construction on a congested site. These risks would include the safety risks of performing multiple work tasks in the same general vicinity. A larger site also helps mitigate risks to the overall project cost by reducing unproductivity and inefficiency of multiple construction workers trying to all work in close proximity to one another.

3. Most major components are covered under the contract between the Original Equipment Manufacturer ("OEM") of the CTs and OG&E. Since these CTs are part of a mature product line in service at multiple locations worldwide, their outstanding performance is well documented. A similar facility in Bayone, NJ has well over a 99% availability factor since it went commercial in 2012. During such time, those units have experienced over 19,000 starts. As such, the performance risk was determined to be minimal and what risk remains is covered under the warranty provisions of that contract.
4. Construction, commissioning and startup activities are being managed by Burns and McDonnell which has a wealth of experience performing the same tasks on numerous similar projects.

Q. **Can you please discuss how contracts for equipment, materials and services were awarded?**

A. Yes. Once engineering had progressed to the point that sufficient technical detail had been developed to support the creation of technical specifications, contract bid packages were prepared based on those specifications and issued for bid. Most events had a "pre-bid" meeting to answer any questions from prospective contractors and afford them the opportunity to visit the site. Following the prebid meeting, a period of time was set aside for contractors to develop their proposals. Following the bidding period, the proposals were evaluated by OG&E and its Owners Engineer (Burns and McDonnell) and finalists were selected. Negotiations were then conducted with the finalists, resulting in a selected contractor and an awarded contract based on the lowest reasonable risk adjusted price. All contract packages followed a similar process. The timeframes and durations for each procurement event varied based on a number of factors including, the number of bidders, the complexity of the scope of supply, the difficulty of the negotiations and the schedule needed to have a contract in place.

The largest contracts related to the Mustang project were the contracts for the procurement of the combustion turbines (approximately $170 million), the foundation and substructures construction (approximately $26.3 million) and the general installation contract (approximately $38.4 million).

Q. **Did OG&E utilize any other contracting techniques to provide additional value for customers?**

A. Yes. A number of critical contracts were negotiated with schedule and performance liquidated damage ("L/D") clauses. These L/D clauses financially incentivize contractors and suppliers to provide materials that meet project specifications in time to support the overall project schedule. Failure to do so triggers pre-negotiated financial penalties. These funds are then used to employ more costly contingency plans to maintain the success criteria of the project. To date, no contractor or supplier has triggered L/D payments. Nevertheless, the L/D provisions have been negotiated and included in the various construction and installation contracts for the benefit of customers.

Q. **What engineering and construction milestones has OG&E already achieved?**

A. The project is presently progressing on schedule and expected to be in service before December 31, 2017. As of May 31, 2017, the overall project progress is at 63% complete. Engineering is nearly complete with only a few minor outstanding items related to non-critical systems. The air permit was received on December 11, 2015, which was required to commence construction. Other permits required for construction were two Storm Water Construction permits and one floodplain permit. All were received prior to construction beginning. Numerous other permits, regarding such things as building occupancy were required and all have been obtained with no delay to construction.

Earthmoving activities began on April 4, 2016, but permit-required construction began on August 5, 2016 with the pouring of concrete for the first foundations. Presently, all major foundations have been poured. Mechanical and electrical work are progressing with Units 6 and 7 nearing mechanical completion. Mustang Units 8, 9, 10, 11 and 12 are in various stages of completion. Regular deliveries of critical equipment are occurring in support of the construction schedule.

Field tanks erected on site are complete and water treatment equipment installation is well underway. The Administration and Control building is complete and has been released to Operations.

Activities necessary to connect the new units to the existing 138 kV and 69kV switchyards are drawing to a close. This connection will allow backfeed of auxiliary power into the plant. Backfeed is expected to be in place sometime in mid-June 2017 and will allow commissioning efforts to begin shortly afterward on the first units being installed.

OG&E has contracted with ONEOK, the lowest bidder for the project, to supply natural gas service to the Mustang facility. ONEOK is installing approximately 20 miles of pipe from its storage facility near Edmond, OK. This work is underway and pipe construction is on pace to have gas available to support the schedule of first fire on Mustang Unit 6 in September of this year.

Q. **What is the estimated cost of these new units?**

A. The project is expected to cost $355 million (exclusive of AFUDC and ad valorem taxes). This represents a $45 million reduction over the initial estimate.

Q. **When does OG&E expect the new units to put power onto the grid?**

A. OG&E expects to have all of the new Mustang units through commissioning initially synchronized to the grid by December 31, 2017. OG&E is on pace to meet that timeline.

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

A. Yes I do. I strongly believe that OG&E has made sound decisions around retiring and replacing the old units at Mustang. Those units clearly needed to be retired, as they have significantly exceeded their original design life and are experiencing typical end of life issues. Mitigating these issues would require very significant levels of investment with no certainty that the units would still operate to 65 years of service. The units are also being used in a cycling mode by the SPP instead of baseload operation, which was their original design basis.

The aero-derivative CTs that were selected for Mustang provide much better operational flexibility than other existing units or other types of CTs, including the ability to start and stop multiple times each day to maximize customer benefit in the SPP market

and to respond in support of a growing percentage of renewable generation in the SPP footprint.

The Mustang site itself provides multiple benefits from transmission system reliability to significant cost savings from a greenfield site. Lastly, I am pleased to say the project is coming in on time and, to date, significantly under budget.

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

A. Yes.

CERTIFICATE OF SERVICE

I, Lawrence E. Chisenhall, Jr., hereby state that a copy of the foregoing instrument was served on all the parties of record via the APSC Electronic Filing System on this the 15th day of August, 2017.

/s/ Lawrence E. Chisenhall
Lawrence E. Chisenhall, Jr.

APSC FILED Time: 8/15/2017 3:00:27 PM: Recvd 8/15/2017 2:54:54 PM: Docket 17-030-U-Doc. 27

BURNS McDONNELL

May 24, 2017

Mr. Rob Burch
Managing Director Power Supply Services
OGE Energy Corp
321 North Harvey Avenue
Oklahoma City, OK 73102-3405

Re: Greenfield versus Brownfield Savings Assessment

Dear Mr. Burch:

At the request of OG&E, Burns & McDonnell (BMcD) reviewed the estimate for the installation of seven Trent 60 simple cycle combustion turbines at the Mustang Power Plant in March 2016. The purpose of our review and the assessment below was to identify specific areas where use of the Mustang "brownfield" facility has generated project savings opportunities as compared to typical costs to develop a nominal "greenfield" site for similar purposes. We reviewed the March 2016 Greenfield versus Brownfield assessment, and are of the opinion that the estimates provided are still reasonable.

Brownfield vs Greenfield Estimated Savings*		
Savings:	**OGE Mustang**	**Notes**
Switchyard	$8,000,000	
GSU	$1,000,000	Re-use of existing Mustang Units 1 and 2
Transmission to Site	$15,000,000	Assuming 10 miles at $1.5MM/mile
Water Treatment	$0	Water treatment savings negated by well water system upgrade
Gas		Gas Supply costs are not apart of this project
Water	$10,000,000	20 miles at $500k/mile
U/G Utilities onsite (Water/Fire Water/Gas)		Utilities distribution savings; however, within the accuracy of estimates.
Roads/Access		Road savings; however, within the accuracy of estimates.
Security		Fence savings; however, within the accuracy of estimates.
Earthwork	$1,000,000	
Adds:		
Day-lighting	-$1,000,000	Pilot trenching, etc.
Demo/Relocations		
	$34,000,000	
Owners Cost Savings		
Permitting	$0	Air Permit savings; however, within the accuracy of estimates.
Staffing		OG&E sees value, including financial value, in the ability to retain and re-utilize highly trained and capable workforce; however, at this time has not quantified that value.
SPP Interconnect Study	$1,000,000	No study required for Mustang.
SPP Network Upgrades	$10,000,000	Per review of DISIS data (public data on interconnection filings in SPP), we are seeing a range of $10MM - $40MM for a 200MW project.
Total Cost Savings	$45,000,000	

*Estimates and projections prepared by BMcD relating to construction costs are based on experience, qualifications, and judgment as a professional consultant. BMcD has no control over

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weather, cost and availability of labor, material and equipment, labor productivity, construction contractor's procedures and methods, unavoidable delays, construction contractor's method of determining prices, economic conditions, government regulations and laws (including interpretation thereof), competitive bidding and market conditions or other factors affecting such estimates or projections. Actual rates, costs, performance ratings, schedules, etc., may vary from the data provided. The (assessment) herein is screening-level in nature and includes a comparison of costs and characteristics of natural gas simple cycle at a generic Greenfield location in Oklahoma. It is the understanding of BMcD that this Assessment will be used for preliminary information in support of the Owner's internal discussion and understanding of project costs. Any estimated costs of interest to the Owner should be followed by additional detailed studies to further investigate each option and its direct application within the Owner's long-term plans and objectives. All information in this letter is confidential. It is not intended for the development of construction specifications or budget allocations. Further study would be required to develop site-specific performance and cost estimates with improved accuracy.

Sincerely,

Clarice Kinsella
Project Manager

JWM