BEFORE THE CORPORATION COMMISSION OF OKLAHOMA

APPLICATION OF PUBLIC SERVICE COMPANY OF OKLAHOMA ("PS0") FOR APPROVAL OF THE COST RECOVERY OF THE WIND CATCHER ENERGY CONNECTION PROJECT; A DETERMINATION THERE IS A NEED FOR THE PROJECT; APPROVAL FOR FUTURE INCLUSION IN BASE RATES COST RECOVERY OF PRUDENT COSTS INCURRED BY PSO FOR THE PROJECT; APPROVAL OF A TEMPORARY COST RECOVERY RIDER; APPROVAL OF CERTAIN ACCOUNTING PROCEDURES REGARDING FEDERAL PRODUCTION TAX CREDITS; WAIVER OF OAC 165:35-38-5(e); AND SUCH OTHER RELIEF THE COMMISSION DEEMS PSO IS ENTITLED	)	CAUSE NO. PUD 201700267

RESPONSIVE TESTIMONY OF

ANDREW RAWLINS

ON BEHALF OF

PLAINS AND EASTERN CLEAN LINE OKLAHOMA LLC

REDACTED

December 4, 2017

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EXHIBITS

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Andrew Rawlins. My business address is 1120 South York Street, Denver, Colorado 80210.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?

A. I own a private consulting firm, Rawlins Transmission Consulting, through which I provide transmission line consulting services to electric utilities and private developers.

Q. ON WHOSE BEHALF ARE YOU TESTIFYING IN THIS PROCEEDING?

A. I am testifying on behalf of Plains and Eastern Clean Line Oklahoma LLC ("Plains and Eastern").

Q. PLEASE PROVIDE A SUMMARY OF YOUR EDUCATIONAL BACKGROUND.

A. I graduated from Purdue University with a Bachelor's of Science Degree in Civil Engineering.

Q. DO YOU HOLD ANY PROFESSIONAL LICENSES?

A. Yes, I am a registered Professional Engineer with the State of Colorado, the State of California, and the State of Texas.

Q. PLEASE DESCRIBE YOUR PROFESSIONAL BACKGROUND.

A. I have 39 years of experience in the electric utility business: five years at the Bureau of Reclamation, six years onsite at Western Area Power Administration's ("WAPA") headquarters with two consulting firms as a project engineer, 18 years with Black & Veatch (a global engineering, procurement, and construction firm) as a project engineer and a

project manager, and 10 years as a private consultant working primarily with Black & Veatch. In addition to design experience, I have extensive experience in developing schedules, cost estimates and construction specifications for transmission lines. My experience includes these activities for high voltage projects including AC (345 and 500 kV) and DC lines (+/- 400, 500 and 600 kV).

Q. HAVE YOU PREVIOUSLY TESTIFIED IN ANY ADMINISTRATIVE OR JUDICIAL PROCEEDINGS?

A. Yes. I testified before the Arizona Power Plant and Transmission Line Siting Committee in Docket No. L-00000AAA-16-0370-00173, Case No. 173, concerning Southline's Application for Certificate of Environmental Compatibility. I testified before the New Mexico Public Regulation Commission in Case No. 17-00040-UT, concerning Southline's Application for Approval of Transmission Facilities. I have also testified before the Colorado Public Utilities Commission in the Docket No. 03A-192E.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. First, I will provide my view of the status of Plains and Eastern's development work on their transmission project running east from the Oklahoma Panhandle. I then will review the development work to date and cost estimate of Wind Catcher's proposed transmission line and highlight how using the Plains and Eastern project as the Wind Catcher transmission link could mitigate some of the risk of cost overruns. I will review the proposed schedule of the development and construction of the Wind Catcher transmission line and describe how using the Plains and Eastern project would mitigate schedule risk and make it much more likely that the project comes on-line on time. Finally, I will describe

how the Plains and Eastern project could be utilized to deliver power to PSO's service territory in eastern Oklahoma.

II. ANALYSIS OF PLAINS AND EASTERN'S DEVELOPMENT WORK

Q. HOW WOULD YOU CHARACTERIZE THE STATUS OF DEVELOPMENT OF THE PLAINS AND EASTERN PROJECT?

A. The development of the project is essentially complete. Plains and Eastern went through the full NEPA (National Environmental Policy Act) process to determine the best route based primarily on environmental factors and stakeholder concerns. They obtained public input at various stages of the multi-year process via a series of public meetings. During and since that process was completed, Plains and Eastern held thousands of meetings with landowners resulting in routing adjustments to help alleviate landowner concerns. Key environmental permits have been obtained so that the route can be considered fully developed, permitted and approved.

Pre-construction activities are well along for the potential first phase of the project that extends from the Oklahoma panhandle to the Tulsa area. Approximately 60% of the right-of-way("ROW") easements have been obtained and access road plans have been developed. Environmental field surveys have been completed on the majority of the route. Plains and Eastern has completed most of the structure design required and has performed structure spotting along the alignment and several geotechnical investigations and studies. Interconnection studies have been completed and Plains and Eastern has agreements with several Oklahoma businesses to provide goods and services for the project.

Q. WHAT ARE THE LONGER LEAD TIME ITEMS THAT ARE KNOWN TO DELAY CONSTRUCTION AND TO INCREASE COSTS THAT HAVE BEEN ACCOMPLISHED?

A. Several major activities can wreak havoc on a schedule, including acquiring enough right-of-way to begin construction, environmental permitting, and survey activities. Additionally, conversing with the affected landowners requires a lot of back and forth effort to come up with a final right-of-way that addresses landowner concerns without unduly affecting engineering and cost concerns. It took over five years to obtain an approved route on one project I am involved with (not Plains and Eastern) and that route is still being adjusted due to the concerns of landowners, gas pipeline owners, and county road departments. Property surveys have found additional easements that have forced the ROW to shift and the design is being affected by ongoing environmental surveys. The delays and changes are affecting not only the cost of development but the capital cost of the project due to the addition of angle and dead-end structures needed to avoid conflicts. The development and control of a definitive route is Plains and Eastern's biggest accomplishment. The NEPA process takes a long time but results in a selected corridor that is defensible.

Q. WHAT ARE THE BENEFITS OF HAVING ACHIEVED THESE DEVELOPMENT MILESTONES?

A. Simply, these milestones provide much more cost certainty and schedule certainty. Schedule and cost in transmission line construction are inter-related. The less that is known about a route, the greater the potential for increased project costs. Schedule delays in one area can perpetuate schedule delays in other areas and costs can continue to escalate. A right-of-way with less certainty typically can mean more conflict with landowners which

translates into higher costs and more scheduling risk. In my experience it is unusual for a fixed price contract to be signed with a construction contractor before the route is known.

III. ANALYSIS OF WIND CATCHER TRANSMISSION LINE DEVELOPMENT WORK AND COST ESTIMATE

Q. HAVE YOU REVIEWED THE INFORMATION PROVIDED ABOUT THE STATUS OF DEVELOPMENT OF THE WIND CATCHER TRANSMISSION LINE?

A. Yes. I've reviewed PSO's Wind Catcher testimony, the data requests and responses, and many of the exhibits they have produced including the EPC contract and other Confidential and Highly Sensitive attachments.

Q. HOW WOULD YOU CHARACTERIZE THE STATE OF DEVELOPMENT OF THE WIND CATCHER TRANSMISSION LINE?

A. Wind Catcher's transmission line development is nowhere near as far along as Plains and Eastern's. Wind Catcher has completed a desk-top study of preliminary routes, though they characterized it as, "purely for the purpose of developing an EPC contract." Wind Catcher signed an EPC contract with Quanta in late July 2017, and Quanta is responsible for performing their own routing analysis. Per the EPC contract, final route selection is to occur by December 22, 2017, though it appears that Quanta is not required to have any contact with landowners prior to that date except for a set of open houses held in October 2017 that presented their preliminary route corridors. As Plains and Eastern experienced, I expect many landowners will want to modify the final route, and even more so if they feel they weren't given ample opportunity to voice their concerns. In my experience, the public's buy-in is much easier if people feel their opinions were seriously considered in the routing phase. Many people won't get involved until a preferred route is chosen, at which

point, oftentimes, landowners only learn that their land will be impacted by word of mouth from their neighbors. That is why I feel the affected landowners need to be given the opportunity to weigh in before the preferred route is finalized.

Q. HAVE YOU REVIEWED THE COST ESTIMATE FOR THE TRANSMISSION LINE?

A. I reviewed the detailed cost estimates provided as part of DR-OIEC-3-13, Attachment 2. The values for Wind Catcher's "Central Route" cost estimate appear to be similar to the values contained in the EPC contract.

Q. HOW WOULD YOU DESCRIBE THE LEVEL OF PRECISION OF THE COST ESTIMATE?

A. I can only assume that the unit pricing utilized came from AEP's experience on 765 kV projects. PSO's transmission line cost estimate worked out to about $[redacted]/mile which appears to be on the low end of the scale when compared to published cost estimates I found for 765 kV. Even AEP's own "Transmission Facts" published in 2008 estimated the cost of 765 kV transmission at $2.6M to $4M/mile. PSO-provided costs for two recent 765 kV projects that were competitively bid were listed at $[redacted]/mile and $[redacted]/mile, excluding ROW and financing costs. I suspect one reason the Wind Catcher number is low is because they assumed that about 95% of the structures would be tangents and only the remaining 5% would be angles and dead-end structures. I would expect there will be a much higher percentage of angles and dead-ends, which are often necessary to satisfy the legitimate concerns of landowners. DR-OIEC-3-13, Attachment 2 also included an alternatives comparison footnoted with, "Cost estimates based on central line route with few angles/dead-ends." It also showed Quanta's estimate for the total project cost using

the central route to be 99.74% of AEP's cost estimate. Though the basis of the EPC contract is not well defined in its attachments, I expect the 95%/5% ratio is assumed and that the contract price would increase as more turning structures are added.

The estimate did not include a contingency line item and I was unable to tell if a contingency was included in the individual line items. Due to the accelerated schedule and the degree of uncertainties, a large contingency is warranted. Transmission line schedules developed early in project development are rarely kept and typically see significant delays. Early cost estimates often utilize optimistic assumptions and are susceptible to change. Construction costs always go up when schedules are dragged out due to changes in the assumed work plan.

Q. WHAT LEVEL OF CERTAINTY COULD YOU PUT AROUND THE COST ESTIMATE?

A. That is very hard to assess given the large number of unknowns, but I wouldn't be surprised to see the final EPC price come in 20% above the contract price.

Q. HOW COULD PLAINS AND EASTERN'S DEVELOPMENT WORK REDUCE UNCERTAINTY ON COSTS?

A. Utilizing a route that has been fully vetted would provide certainty on the number and types of structures required. It would also reduce cost uncertainties due to schedule risk. Plains and Eastern's extensive environmental permitting work would also reduce the risk of added costs from environmental issues that could arise. It does not appear that PSO has performed much or any right-of-way acquisition nor any environmental surveys. These unknowns could raise project costs substantially.

Q. DID YOU REVIEW THE WIND CATCHER TRANSMISSION LINE PROJECT SCHEDULE? HOW WOULD YOU DESCRIBE THE LEVEL OF CERTAINTY IN THE SCHEDULE?

A. Yes, I reviewed the schedule and the revised schedule. I noted that the schedule has already begun to get pushed out and has leaked into 2021. This is not surprising since the schedule is extremely aggressive leading up to the start of construction. In particular, their right-of-way acquisition plan looks overly optimistic compared to the time period most owners would allocate to a project of this size. Based upon the language in Exhibit U of the EPC contract, it appears they may be mitigating this risk by limiting the number of contacts made to landowners before beginning eminent domain legal proceedings. Per the contract, those proceedings begin within [redacted] days if [redacted] Based upon these limited attempts to work with landowners, it appears there may need to be a significant number of land parcels acquired through condemnation, which can also create some additional uncertainty.

Q. WHAT WOULD GIVE SOMEONE MORE COMFORT THAT THE SCHEDULE CAN BE MET?

A. Route certainty and a reasonable level of right-of-way acquisition would go a long way toward making sure construction could begin on time.

Q. CAN YOU THINK OF EXAMPLES WHERE COSTS HAVE ESCALATED SUBSTANTIALLY, OR SCHEDULE PUSHED DRAMATICALLY FROM WHAT WAS INITIALLY PREDICTED?

A. Transmission line construction often results in schedule delays and cost increases, especially when there is a tight schedule from the outset. Delays occur due to things like landowner/ROW issues, material delivery issues, construction labor/equipment issues,

environmental restrictions, weather delays, etc. Initial problems tend to have a cascading effect because everyone's plans are thrown out of whack. Construction labor contracts are particularly susceptible to change orders because delays cause workers to stand around with nothing to do or keep them from moving on to the next job that the contractor has committed to. These delays usually leads to a lot of overtime pay and premiums paid to bring in additional labor. Failure to complete pre-construction activities on time can also delay the overall schedule.

IV. TECHNOLOGY CHOICE/ENGINEERING SPECIFICATIONS

Q. WHAT TYPE OF TECHNOLOGY HAS WIND CATCHER CHOSEN FOR ITS TRANSMISSION SOLUTION?

A. AEP-PSO is proposing to build a 765 kV alternating current transmission line.

Q. WHY DID THEY CHOOSE THIS TECHNOLOGY?

A. AEP has been using 765 kV for many years for its largest transmission lines. To my knowledge they are the only ones in the country using 765 kV. In the western U.S., the maximum AC voltage utilized is 500 kV, while the maximum voltage used in SPP is 345 kV. Other utilities have shied away from using 765 kV in large part because it puts "too many eggs in one basket". For system reliability purposes, they typically prefer two smaller lines rather than one big line to reduce the impact of a single line outage.

Q. WHAT OTHER TECHNOLOGIES DO YOU BELIEVE SHOULD BE CONSIDERED GIVEN THE WIND CATCHER PROJECT'S GOAL OF DELIVERING 2,000 MW OVER A DISTANCE OF AROUND 350 MILES?

A. As shown in DR-AG-8-6, Attachment 1, AEP also considered using double-circuit 345 kV transmission lines or ±600 kV HVDC. Their analysis showed the 765 kV alternative to be

the most cost effective. From my experience ±600 kV HVDC may be more suited for a higher capacity line. I suspect the HVDC suppliers could have provided costs for a more optimum, lower voltage, HVDC line had they been asked. On the other hand, the design with a ±600 kV HVDC could allow for about 4,000 MW of transfer capability, double the amount that is proposed by AEP. Double circuit 345 kV is a viable option and could result in lower costs, easier interconnection and reliability benefits.

V. THE ROLE OF PLAINS AND EASTERN IN WIND CATCHER

Q. IS IT YOUR UNDERSTANDING THAT THE PLAINS AND EASTERN PROJECT COULD BE UTILIZED TO SERVE AS THE TRANSMISSION LINK TO DELIVER WIND POWER FROM THE PANHANDLE TO PSO AND OTHER UTILITIES IN EASTERN OKLAHOMA?

A. Yes. My understanding from Plains and Eastern is they are open to using the project to deliver power from the Panhandle to eastern Oklahoma. The Project's route could be adjusted in eastern Oklahoma to reach the desired interconnection points in PSO's service territory and a short link could be constructed to connect Wind Catcher's generation site to the Plains and Eastern Project.

Q. FROM AN ENGINEERING PERSPECTIVE, IS THERE ANY REASON THE PLAINS AND EASTERN PROJECT COULDN'T BE USED FOR THE PURPOSES WIND CATCHER SEEKS TO ACCOMPLISH.

A. No. My understanding is that Plains and Eastern is also willing to consider an AC line if that is desired and what the customer wants. A large majority of the development work that has been completed could be used for any type of transmission lines, whether it is AC or DC. Plains and Eastern's easements are typically for up to 200 feet in width which should be sufficient to build AC or DC.

Q. WOULD USING THE PLAINS AND EASTERN PROJECT MITIGATE THE RISKS OF COST OVERRUNS AND SCHEDULE DELAYS PREVIOUSLY DESCRIBED?

A. Yes it would.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes it does.

Independent Consultant

Project Engineering and Project Management

Education
Bachelors, Civil, Purdue University, 1978

Professional Registration
PE, Texas, 2012
PE, California, 1992
PE, Colorado, 1982

Total Years Experience
39

Andrew G. Rawlins is an independent consultant specializing in conceptual design, permitting, cost estimating, and project management of high voltage transmission line projects.

Rawlins' engineering experience includes various assignments on high voltage overhead and underground transmission lines and substations at voltages ranging from 69 kV through 500 kV. His current responsibilities include technical studies, feasibility analyses, cost estimating, conceptual design, route selection, permitting support, technical review of engineering designs and specifications, and construction support.

Rawlins formed his own company in July 2007 after being employed by Black & Veatch (B&V) for nearly 18 years, and worked as a consultant in B&V's offices through September 2017. Prior to joining B&V, he was employed for six years by two other consulting firms and for five years by a federal agency.

Project Experience

Southline 345/230 kV Transmission Project – Southline Transmission LLC: Arizona and New Mexico 2011-2017
B&V Transmission Line Engineering Manager. Transmission Line Engineering Manager for permitting and design of approximately 220 miles of double-circuit 345 kV transmission line. The project also includes rebuilding 120 miles of single circuit 115 kV to double circuit 230 kV. B&V services included conceptual design, routing/permitting support, public meeting attendance, expert testimony, and detailed design. Ongoing support is being provided directly to the owner, Hunt Transmission Services. Construction is scheduled to begin in 2018.

CREZ 345 kV 2nd Circuit – Sharyland Utilities: Texas 2016-2017
B&V Transmission Line Engineering Manager. Transmission Line Engineering Manager for design of 2nd circuit addition to four existing 345 kV transmission lines totaling 166 miles. Services included detailed design, material procurement support, development of construction specifications, and construction support. Construction started in 2016 and is scheduled to be completed in 2018.

North Edinburg - Palmito 345 kV Transmission Line – Sharyland Utilities: Texas 2014-2016
B&V Transmission Line Engineering Manager. Transmission Line Engineering Manager for design of a 48-mile 345 kV steel pole transmission line near the Texas gulf coast. Services included detailed design, material procurement support, development of construction specifications, and construction support.

AEEC-White River 345 kV Transmission Line – Sharyland Utilities: Texas 2014-2016
B&V Transmission Line Engineering Manager. Transmission Line Engineering Manager for design of a 51-mile 345 kV steel pole and lattice tower transmission line in the Texas panhandle. Services included detailed design, material procurement support, development of construction specifications, and construction support.

HVDC Feasibility Analyses – Various Clients: USA 2008-2015
B&V Engineering Manager. Engineering Manager providing engineering support and cost estimating on five proposed HVDC transmission projects for confidential clients:

- 105 mi. in eastern TX, 1000-1250 MW, ±320 or ±400 kV, 2014-2015;
- 480 mi. in upper Midwest, 2400 MW, ±320 or ±400 kV, 2009-2013;
- 160 mi. in southeastern TX, 1000 MW, ±320 kV, 2011;
- 220 mi. in southern CA, 2000-3000 MW, ±500 kV, 2009-2010;
- 730 mi. in western US, 2500-3000 MW, ±500 or ±600 kV, 2008-2012;

Services included cost estimating and conceptual design of overhead, underground, and submarine segments. Specialty services included route assessments, loss analyses, conductor size optimization, and construction details for railroad ROW.

CREZ 345 kV Transmission Project – Sharyland Utilities: Texas 2007-2013
B&V Transmission Line Engineering Manager. Transmission Line Engineering Manager for conceptual studies and detailed design of 300 miles of double-circuit 345 kV transmission line in the Texas panhandle. Services included conceptual design, detailed cost estimating, routing/permitting support, public meeting attendance, design of a new 345 kV double circuit lattice tower family, development of procurement specifications for all major materials, development of construction specifications, bidding support, and construction support.

Various Projects – Multiple Clients: Western USA 2001-2007
Project Manager. Black & Veatch. Project Manager on multiple high voltage transmission line and substation projects. Responsible for project planning/scheduling and managing engineering teams from the conceptual stage through construction. Projects included both design-only and EPC scopes.

DREP 500 kV Transmission Line – Desert Rock Energy Project: New Mexico and Arizona 2006-2007
B&V Project Manager. Project Manager for the conceptual design and development of EPC specifications for 42 miles of new 500 kV transmission line alignment and 172 miles of alignment previously permitted as the Navajo Transmission Project. The project included aerial and ground survey subcontracts, permitting support, title insurance support, and development of detailed specifications for an engineering, procurement, and construction contract.

Eastern Interconnection Feasibility Study – EPG/San Diego Gas & Electric: California 2003-2004
B&V Project Manager. Project Manager for the feasibility study of a new 500 kV interconnection on the eastern side of San Diego. B&V, acting under a subcontract to Environmental Planning Group (EPG), performed the technical evaluations and detailed cost estimates for new 500 kV substations and transmission lines as well as for new and upgraded 230 kV facilities.

Various Projects – Multiple Clients: Western USA 1989-2001
Transmission Line Project Engineer. Black & Veatch. Responsible for routing, conceptual design, cost estimating, detail design, development of procurement and construction specifications, management of geotechnical and surveying subcontracts, and construction support for high voltage transmission line projects.

Navajo Transmission Project – Diné Power Authority Navajo Nation: New Mexico, Arizona, and Nevada 1994-2002
B&V Transmission Line Project Engineer. Responsible for the conceptual design and spotting of 462 miles of 500 kV transmission line.

Marketplace-Allen 500 kV Transmission Line – Nevada Power Company: Nevada 1992
B&V Transmission Line Project Engineer. Responsible for routing, conceptual design, and cost estimating for two proposed 500 kV transmission lines approximately 53 miles in length each. Included extensive routing reconnaissance and right-of-way cost investigations.

Various Projects – Western Area Power Administration: Western USA 1986-1989
Senior Structural Engineer. Lee Wan & Associates. Performed civil-structural design on high voltage transmission line projects.

California-Oregon Transmission Project, Olinda-Tracy 500 kV Transmission Line Uprate – Western Area Power Administration: California 1986-1989
Senior Structural Engineer. Lee Wan & Associates. Responsible for all structural design services including joint detailing, required to modify 171 miles of double-circuit 230 kV lattice towers to single-circuit 500 kV towers for six different tower designs. Tower types modified include 437-foot and 358-foot high river crossing towers and the adjacent deadends. Designs also included converting a medium-angle deadend design to a 6-legged medium and an 8-legged heavy angle design.

Various Projects – Western Area Power Administration: Western USA 1983-1985
Senior Structural Engineer. J. F. Sato & Associates. Performed civil-structural design on high voltage substation and transmission line projects.

Various Projects – US Bureau of Reclamation: Western USA 1978-1983
Senior Structural Engineer US BUREAU OF RECLAMATION. Civil-structural design and construction inspection of high voltage substation and transmission line projects.