BEFORE THE CORPORATION COMMISSION OF OKLAHOMA

IN THE MATTER OF THE APPLICATION OF OKLAHOMA GAS AND ELECTRIC COMPANY FOR AN ORDER OF THE COMMISSION APPROVING THE COMPANY'S 2016 DEMAND PORTFOLIO AND AUTHORIZING RECOVERY OF THE COSTS OF THE DEMAND PROGRAMS THROUGH THE DEMAND PROGRAM RIDER	)	CAUSE NO. PUD 201 500217

Direct Testimony

of

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of

ADM Associates Inc.

on behalf of

Oklahoma Gas and Electric Company

July 1, 2015

I. INTRODUCTION

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

A. My name is Adam D. Thomas. I am a Director of EM&V Studies at ADM Associates Inc. ("ADM"), 3239 Ramos Circle, Sacramento, CA 95827.

Q. **What is ADM's role in this proceeding?**

A. ADM was engaged by Oklahoma Gas and Electric Company ("OG&E" or "Company") to develop evaluation, measurement, and verification ("EM&V") protocols for their 2016-2018 filing of energy efficiency programs, and to review program designs and technical assumptions used in the program designs.

Q. **Please describe your professional education and experience.**

A. I received my Bachelors of Arts in Economics from the University of California at Santa Cruz in 2007 and a Master's of Science in Applied Economics and Finance from the University of California at Santa Cruz in 2008.

In 2008, I was hired by ADM as an Energy Analyst in support of the EM&V of residential, commercial, and industrial programs. ADM is a demand side management consulting firm which has been in business since 1979. My responsibilities in this role included development of measurement and verification plans, analysis of metered data, and statistical analysis to support gross savings impact evaluation.

I was promoted to Senior Analyst in 2010, and then to Director of EM&V studies in 2013. My work in this regard has included conducting statewide EM&V efforts on behalf of the New Mexico Public Regulation Commission for programs implemented under the Efficient Use of Energy Act ("EUEA"), EM&V on behalf of the Arkansas Joint Gas Utilities (CenterPoint Energy, SourceGas Arkansas, and Arkansas Oklahoma Gas), and evaluation for Quick Start Programs for four Louisiana investor owned utilities (Entergy Gulf States, Entergy Louisiana, Southwestern Electric Power Company, and Cleco Power).

Q. **Are you a member of any professional organizations?**

A. I am ADM's representative for several regional energy efficiency networks, including the Southwestern Energy Efficiency Project ("SWEEP") and the Southeastern Energy Efficiency Alliance ("SEEA"). I have presented on evaluation topics at multiple International Energy Program Evaluation Conferences ("IEPEC").

Q. **Have you testified before in regulatory or legislative proceedings?**

A. Yes. I have filed or given testimony before the New Mexico Public Regulation Commission on multiple topics, including recommendations for program cancellation or continuation, EM&V protocols, and status of military facilities under the EUEA.

Q. **Have you previously testified before the Oklahoma Corporation Commission ("OCC" or "Commission")?**

A. No, I have not.

II. PURPOSE OF TESTIMONY

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

A. The purpose of my testimony is twofold. First, I will detail industry best practices in program evaluation. Second, my testimony will discuss the findings from my review of the OG&E portfolio design as well as the development of evaluation protocols for the 2016-2018 program cycle.

III. DEMAND PROGRAM MEASUREMENT AND VERIFICATION

Q. **Is there an industry-standard protocol for EM&V of demand programs?**

A. Yes, the International Performance Measurement and Verification Protocol ("IPMVP") is an industry standard for development and implementation of measurement and verification ("M&V") plans. The IPMVP is regularly updated by industry professionals. IPMVP focuses on the validation of energy savings estimates at the project-level. Additional details of the IPMVP can be found at www.evo-world.org.

For the purposes of program evaluation design, documentation of industry best practices can further be found in the Department of Energy ("DOE") National Renewable Energy Laboratory ("NREL") Uniform Methods Project ("UMP"). The UMP focuses on development of energy savings estimates at the program level, with recommended approaches for common program designs. Chapters from the UMP can be found at http://energy.gov/eere/about-us/ump-protocols.

Other notable evaluation guidelines include:

- The California Public Utilities Commission. *The California Evaluation Framework.* June 2004
- American Society of Heating, Refrigeration and Air Conditioning Engineers ("ASHRAE"). *Measurement of Energy and Demand Savings, Guideline 14.* June 2002.
- Federal Energy Management Program ("FEMP"). *Federal Energy Management Program M&V Guidelines: Measurement and Verification for Federal Energy Projects.* September 2000.

It should be noted that the above-mentioned protocols are generally applicable when conducting more rigorous impact evaluation. It is industry best practice to utilize regional deemed savings values (in which savings for common and/or predictable measures are stipulated, often based on prior local M&V research). There is a long history of use of deemed savings in validating impacts from demand programs, as seen in the development of the California Database for Energy Efficient Resources ("DEER"), the New York State Energy Research and Development Authority ("NYSERDA") Deemed Savings Database, the Pennsylvania Act 129 Technical Reference Manual ("TRM"), the Northeast Energy Efficiency Partnership ("NEEP") Mid-Atlantic TRM, the Arkansas TRM, and the Oklahoma Deemed Savings Documents.

Q. **What is the basic formula used by demand program practitioners in expressing demand and energy savings resulting from a specific project or program?**

A. The impacts of a demand program are generally formulated as:

Demand/Energy Savings = Baseline Demand/Energy – Post-Retrofit Demand/Energy ± adjustments.

"Baseline" refers to energy/demand consumption prior to a retrofit. Many projects will instead use the local minimum code as baseline. Minimum code efficiency is used as the baseline for projects which comprise new construction (since there is no baseline equipment from which to make a comparison) or the replacement of failed equipment (due to the participant's need of purchasing new equipment regardless of the presence of a program, and this new purchase will be subject to current applicable codes).

Q. **What are the steps involved in preparing an EM&V plan to support a particular program?**

A. The steps in preparing an EM&V plan include:

I. Define success metrics and research needs
   a. Define participants
   b. Determine program eligibility and applicable baseline for energy efficiency measures included in the program

II. Select the appropriate EM&V approach
   a. Defining the data collection strategy and rigor level appropriate for the program size and design (e.g., new construction vs. retrofit, downstream inducements to end-users vs. midstream inducements to retailers)
   b. Determine inputs needed for cost-effectiveness testing of the program (energy & gas savings, equipment incremental costs, operational & maintenance impacts)

III. Determine other relevant information to be collected

The EM&V plan takes into consideration the program design, data availability and acquisition costs, the appropriateness of a specified rigor level and associated EM&V costs relative to program budget, and the trade-off of evaluation costs vs. added precision. EM&V protocols were developed for OG&E's program design to define parameters under which the demand programs would have their success measured, and will utilize industry best practices and regionally appropriate deemed savings.

Q. **How does the program design logic affect data collection and other market research requirements?**

A. The program design and logic dictates both data collection requirements and data availability. The most commonly observed program design and logic (both in OG&E's program plan and nationwide) is to overcome the first-cost barrier through rebates for efficient equipment. At its most basic, the impact evaluation of such a program entails determining the quantity and efficiency level of equipment rebated through the program and validating use of the appropriate baseline.

Programs that seek to address other market barriers, including lack of awareness, lack of local technical expertise, or split inducements, require additional data collection to support measurement of market effects.

Programs which target trade allies further need to be assessed as to their success in training and engaging local contractor communities to expand services beyond their current practice.

For OG&E programs which target intervention points beyond an end-user inducement, market research activities will:

I. Identify market barriers;

II. Determine the appropriate and optimal strategy for overcoming these market barriers;

III. Incorporate these strategies into the applicable program offerings; and

IV. Evaluate the effectiveness of these intervention strategies in overcoming market barriers.

Evaluation of market effects hinges upon development of appropriate metrics, which may include customer awareness, changes in product availability, expanded services provided by participating trade allies, etc. OG&E will determine when an alternative market strategy is warranted, and the associated costs with alternative intervention strategies will be incorporated into the inducement budget of each program.

Q. **Are there generally accepted options for conducting the EM&V calculation of savings from demand programs?**

A. Yes. The IPMVP specified four generally-accepted EM&V options for measurement of energy and demand impacts for programs which do not have corresponding deemed savings algorithms. These are: partially measured retrofit isolation, fully measured retrofit isolation, whole building measurement, and calibrated simulation.

Q. **What is "partially measured retrofit isolation"?**

A. Partially measured retrofit isolation entails the use of metering equipment for key parameters which affect energy use. In this option, some parameters in an energy savings calculation are stipulated. An example may include the metering of hours of use for a lighting retrofit while stipulating the wattage reduction associated with the specified baseline and post-retrofit fixtures.

Q. **When is partially measured retrofit isolation appropriate?**

A. Partially measured retrofit isolation is appropriate when changes in usage patterns for a measure or project are limited and easily isolated. An example of this would include retrofits to street lighting, which have scheduled operation and no interactive effects with other systems. For this type of project, spot-metering of power consumption combined with historical hours of use would provide reasonably precise savings estimates.

Q. **What is "fully measured retrofit isolation"?**

A Fully measured retrofit isolation is a more stringent EM&V protocol, in which the affected systems are isolated but no stipulations are allowed. Under fully measured retrofit isolation, all parameters affecting energy use must be measured. This approach may provide the greatest level of certainty and precision in savings estimates, but it is a costly approach and the application of it in EM&V is therefore selective.

Q. **When is fully measured retrofit isolation appropriate?**

A. Fully measured retrofit isolation is appropriate when there are only a limited number of variables driving energy use and minimal interactive effects between the installed

measure and other systems. Further, due to higher cost associated with this approach it is generally appropriate to reserve this for projects with higher impact or higher uncertainty.

Q. **What are some examples of when fully measured retrofit isolation may be too complicated or costly for certain projects?**

A. This becomes costly when there are too many interactive effects associated with a project. One example of this would be a data center installing lighting controls, HVAC improvements, and high efficiency servers. The lighting controls and high efficiency servers both affect the internal load and therefore affect the energy use of the HVAC system. To evaluate the impacts from this suite of measures with fully measured retrofit isolation, it would be necessary to meter the power consumption of the servers, the lighting, and the HVAC system, in addition to other usage parameters such as temperature set point. When there are this many interactive effects, it may be more appropriate to use whole building measurement or calibrated simulation approaches.

Q. **What is "whole building measurement"?**

A. Whole building measurement is an EM&V option which entails use of utility billing data or trended data from a facility Energy Management System ("EMS") to measure the combined impact of energy efficiency improvements made at a facility. In the prior example of a data center, a whole building measurement approach would use pre- and post-retrofit billing data (along with regression-based weather normalization) to evaluate the combined impacts of all measures installed. This approach also captures behavioral impacts such as changes in occupancy or scheduling.

This approach is advantageous in being a cost-effective method of evaluating the impacts of multiple measures, as well as in capturing the "human factors" driving energy consumption. However it does have shortfalls in that:

I. A lengthy post-retrofit data collection period may be needed to evaluate savings, particularly if the measures include improvements which are weather-sensitive (such as a complicated HVAC controls retrofit).

II. The approach cannot be used to evaluate impacts from individual measures within a suite of measures installed at a facility; by design it is limited to capturing the overall energy impact of multiple interactive improvements.

III. Savings may be affected by subsequent actions at the facility which are unrelated to the project. For example, if this data center installs a new row of servers during the post-retrofit period and this is not adjusted for, this approach could yield lower savings than are actually provided by the energy efficiency improvements.

Q. **When is "whole building measurement" appropriate?**

A. Whole building measurement is appropriate when the energy impacts cannot be easily isolated and when there are multiple simultaneous improvements which have interactive effects on energy use. Further, it is appropriate when there can be reasonably stable occupancy levels and equipment configurations for the post-retrofit data collection period.

Q. **What is "calibrated simulation"?**

A. Calibrated simulation involves the use of computer simulation modeling to predict the effects of an energy efficiency improvement over the course of a typical year of local weather. The simulation is calibrated to align with customer bills or from trended EMS data.

If a project receives M&V in real-time, it is necessary to calibrate to pre-retrofit usage data and equipment configurations, and then assess the impact by changing the equipment inputs in the model.

If a project receives *post hoc* M&V (where significant time has elapsed since installation) the calibration is typically performed by using post-retrofit usage data and equipment configurations, with baseline energy use assessed via changing equipment inputs to baseline equipment configurations.

If calibration cannot be achieved solely with customer billing data or facility EMS trending data, it may be necessary to obtain needed inputs via short term metering of select systems.

Q. **When is calibrated simulation appropriate?**

A. Calibrated simulation is useful in that it can capture the effects of multiple interactive measures as well as isolate the effects of individual measures. Further, calibrated simulation can evaluate effects which are too small for whole building simulation to capture.

Individual measures can have their impacts teased out of the overall savings estimates in that the simulation modeling software platforms allow for the evaluator to change inputs one at a time. In the example of a simulated data center, one could first assess the impact of changing to higher efficiency servers, then apply lighting controls, and then apply the HVAC retrofit. In doing so, one would get the *marginal* impact of each improvement, on top of all improvements already input into the post-retrofit model. Further, when applied to a facility with relatively homogenous characteristics, calibrated simulation can be used to develop deemed savings estimates. One example would include small retail facilities. Generally, these facilities have similar equipment configuration and usage patterns, and simulation can be used to address the expected impacts of simple retrofits to an archetypical facility model.

Q. **What is an example of when calibrated simulation can be used to estimate impacts that are too small to capture using whole building measurement techniques?**

A. Typically, a whole-building measurement approach is used for projects which comprise 10% or greater energy savings compared to annual use, and is not recommended to be applied for any less than 5% off of total annual use. This would fail to capture the effects of lower saving measures, such as reflective window or roof coating.

Q. **Can any of these EM&V options be used to calculate deemed savings?**

A. Yes. Partially measured retrofit isolation and calibrated simulation are commonly used to develop deemed savings estimates. Partially measured retrofit isolation relies upon partial stipulation of inputs to energy savings impact calculations. Calibrated simulation, further, can provide typical expected savings if performed on an archetypical model of a common building type (such an office or retail space).

Q. **How are stipulated values for partially measured retrofit isolation developed for use in demand programs?**

A. Stipulated values for partially measured retrofit isolation are generally developed off of prior metering studies used to refine the input parameter. For example, there have been numerous metering studies used to assess the hours of use of residential lighting. These studies are leveraged in developing deemed savings values which have been subject to evaluation scrutiny. Sometimes, when a key parameter is identified has having a higher degree of uncertainty, the deemed value may instead be developed through focused M&V efforts to refine it. For example, in a commercial program evaluation, a specific facility type may be over-sampled for hours of use metering if it is found that there is not sufficient documentation of its hours of use to support a deemed parameter estimate.

Q. **How are calibrated simulation deemed savings developed for use in demand programs?**

A. Calibrated simulation models can be used to develop deemed savings by assessing the impact of a common measure configuration onto the appropriate archetypical building model. This model would utilize local building codes and construction practices, local building vintages, and common measure parameters. This simulation would then apply Typical Meteorological Year ("TMY") Weather Data for major metropolitan centers (e.g., weather zone cities) to develop an estimate of expected impacts of this measure.

These models would utilize data for occupants' typical use of HVAC systems, water, and appliances, derived most commonly from prior end-use load shape studies.

Q. **How can deemed values for one geographic region be applied to another?**

A. Many key measures do not display significant variation in savings based solely on geography. This would include hours of operation for lighting in common facility types (such as retail, offices, hospitals, etc.).

For measures that do have variation in savings by geography, values from one region may be applied to another region if the appropriate inputs are modified. The key inputs which may differ geographically are weather, building and energy codes, and

construction practices. Doing so assumes that certain key usage characteristics (such as lighting, appliance, and water heating loads) are similar across regions. This assumption has been validated in several end-use metering studies conducted by the California Energy Commission, NYSERDA, the Bonneville Power Administration, and utilities nationwide.

Deemed values derived for other geographic regions would need to be normalized to the appropriate TMY Weather Zone City. This would allow for a calibrated model from one region to be translated to the weather of another region.

Building codes, standards, and practices can be assessed through local research and subsequent application of these codes, standards, and practices to a calibrated simulation model.

Q. **What did your review of the OG&E program plan consist?**

A. My review of the OG&E program plan entailed:

I. A review of deemed savings assumptions used for all programs;

II. A review of measure incremental cost assumptions used for all programs; and

III. A critique of program design and delivery mechanisms proposed in the draft program plan.

Q. **What did you find in your review of deemed savings assumptions?**

Generally, the OG&E program plan cited the Oklahoma Deemed Savings Documents for measure-level savings. In these instances, ADM's review consisted of an audit of the measure calculation spreadsheets used by CLEAResult to ensure that savings were calculated in a manner compliant with the Oklahoma Deemed Savings Documents. However, there were measures in the program plan which are not included in the current Oklahoma Deemed Savings Documents and thus cited other sources for deemed savings. For these measures, the citation was identified, and subsequently a minimum of three alternative sources were identified for purposes of comparison. In many cases, this yielded no change in energy savings. In total, this review identified 11 measures which warranted revision to deemed savings, and all 11 recommendations were adopted into program design.

Q. **What did you find in your review of measure incremental costs?**

Measure incremental costs were all derived from outside sources as this is not currently included in the Oklahoma Deemed Savings Documents. As with deemed savings, my review consisted of identifying a minimum of three possible citations from existing literature for comparison against listed values. In total, this review identified seven measures which warranted revision to incremental costs, and all seven recommendations were adopted into program design.

Q. **What did you find in your critique of program design and delivery mechanisms?**

Our critique of program design and delivery mechanisms found that the programs included in the OG&E plan used well-established delivery mechanisms which are commonly seen both regionally and nationwide. Major comments pertaining to these designs included:

I. A request for clarification on eligibility of multi-family housing within the Positive Energy New Home Construction Program ("PE-NHC").

II. Further detail on the documentation needed to support eligibility for the Weatherization Residential Assistance Program ("WRAP").

III. Inclusion of first-cost barrier as a market barrier in the Home Energy Efficiency Program ("HEEP").

IV. Clarification on difference in inducement levels between the large business and small business components of the Commercial Energy Efficiency Program ("CEEP").

V. A suggestion that first-year savings may be possible for the Integrated Volt Var Control Program ("IVVC").

In review of the final version of the program plan, I found that CLEAResult and OG&E were responsive to my recommendations and questions pertaining to program design and delivery.

Q. **Do the EM&V protocols detailed in the OG&E program plan adhere to the industry best practices detailed in your testimony?**

A. Yes. At the request of OG&E, ADM authored the EM&V protocols used in the OG&E program filing. The thought process behind this decision was that it would allow for a greater degree of independence in establishment of the program EM&V protocols, in that their design was separate from the design of the programs and portfolio overall. This approach is analogous to the EM&V process insomuch that independence of the evaluation activities serves as an external validation of program implementation activities. This process was extrapolated to this program plan in that the program design consultants (CLEAResult Consulting, Inc., or "CLEAResult") were not in the position of authoring the protocols for how their own program designs would be evaluated.

The EM&V protocols included in the OG&E program plan were designed to adhere to industry best practices, and can ensure proper validation of net energy savings from OG&E 2016-2018 programs.

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

A. Yes it does.