**STATE OF OKLAHOMA**

**BEFORE THE CORPORATION COMMISSION**

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| **In the Matter of The Application of** | **)** | |
| **Oklahoma Gas and Electric Company** | **)** | **Cause No. PUD 201100087** |
| **for an Order of the Commission** | **)** | |
| **Authorizing Applicant to Modify its** | **)** | |
| **Rates, Charges, and Tariffs for Retail** | **)** | |
| **Electric Service in Oklahoma** | **)** | |

# DIRECT TESTIMONY OF

**PAUL CHERNICK**

**ON BEHALF OF**

**THE SIERRA CLUB**

Resource Insight, Inc.

**NOVEMBER 9, 2011**

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Exhibit PLC-1 *Professional Qualifications of Paul Chernick*

## I. Identification and Qualifications

**Q: Mr. Chernick, please state your name, occupation and business address.**

A: I am Paul L. Chernick. I am the president of Resource Insight, Inc., 5 Water Street, Arlington, Massachusetts.

**Q: Summarize your professional education and experience.**

A: I received an SB degree from the Massachusetts Institute of Technology in June 1974 from the Civil Engineering Department, and an SM degree from the Massachusetts Institute of Technology in February 1978 in technology and policy. I have been elected to membership in the civil engineering honorary society Chi Epsilon, and the engineering honor society Tau Beta Pi, and to associate membership in the research honorary society Sigma Xi.

I was a utility analyst for the Massachusetts Attorney General for more than three years, and was involved in numerous aspects of utility rate design, costing, load forecasting, and the evaluation of power supply options. Since 1981, I have been a consultant in utility regulation and planning, first as a research associate at Analysis and Inference, after 1986 as president of PLC, Inc., and in my current position at Resource Insight. In these capacities, I have advised a variety of clients on utility matters.

My work has considered, among other things, integrated resource planning, the cost-effectiveness of prospective new generation plants and transmission lines, retrospective review of generation-planning decisions, ratemaking for plant under construction, ratemaking for excess and/or uneconomical plant entering service, conservation program design, cost recovery for utility efficiency programs, the valuation of environmental externalities from energy production and use, allocation of costs of service between rate classes and jurisdictions, design of retail and wholesale rates, and performance-based ratemaking (PBR) and cost recovery in restructured gas and electric industries. My professional qualifications are further summarized in Exhibit PLC-1.

**Q: Have you testified previously in utility proceedings?**

A: Yes. I have testified over 250 times on utility issues, before regulators in over thirty U.S. jurisdictions and five Canadian provinces. My previous testimony is listed in my resume.

## II. Introduction

**Q: For whom are you testifying?**

A: My testimony is sponsored by the Sierra Club.

**Q: What is the purpose of your direct testimony?**

A: The Sierra Club asked that I review the adequacy of resource planning and acquisition by Oklahoma Gas and Electric (OG&E or the Company).

**Q: What specific issues does your testimony address?**

A: My testimony addresses the following issues:

- the importance of active monitoring of resource availability and acquisition of cost-effective resources,
- the issues confronting OG&E's planning,
- the resources that OG&E should be monitoring and/or acquiring in the near term,
- the quality of OG&E's resource monitoring and acquisition.

**Q: Please summarize your conclusions.**

A: My major conclusions are as follows:

- Integrated electric utilities should always monitor the availability of resources and assess the economics of acquiring those resources under existing conditions and in response to possible future contingencies.
- Where resources are available that would decrease ratepayer costs, the utility should endeavor to acquire those resources, even if the utility's currently owned and contracted resources would provide adequate reliability.
- Assessing and acquiring resources is particularly important for utilities that face the possibility of major expenditures to maintain the load-resource balance.
- The Company faces major expenditures to keep several of its generation units on line over the next several years, due to emerging limits on pollution emissions.
- While OG&E acknowledges its responsibility to "provide options for complying with state and federal environmental mandates" and "pursue options that meet legal requirements at the lowest cost" (Langston Direct at 12, ll. 25–27), it has not taken the actions necessary to meet this responsibility.
- Were OG&E to ramp up an energy-efficiency portfolio comparable to those of industry leaders, it could reduce energy requirements by 3,720 GWh and capacity requirements by about 900 MW by 2022, at a cost of about 5¢/kWh. This efficiency path would reduce energy bills, whether or not any OG&E power plants are retired or otherwise limited in the next few years.
- Vast wind potential exists in Oklahoma and surrounding states. The costs of recent wind-power acquisitions suggest that ratepayers would be better off with additional wind power, regardless of the fate of the existing fossil plants.

- In the Southwest Power Pool and other areas close to OG&E, there are approximately nine merchant gas-fired combined-cycle power plants, totaling nearly 7,000 MW, that may be available to the Company as long-term resources. Many recent sales of gas combined-cycle plants in this region have been for less than $500/kW, which is less than half OG&E's estimate of the cost of new gas combined-cycle.
- The Company has performed poorly in assessing and planning for acquisition of these resources. OG&E has not developed plans for maximizing customer savings from energy efficiency, or identifying and acquiring cost-effective wind resources. It has not identified the gas resources available for purchase or monitored the market price of recent sales of gas combined-cycle plants.

**Q: What are your recommendations for the Commission in this proceeding?**

A: The Commission should find that OG&E's resource planning and acquisition has been inadequate. Specifically, the Commission should require the Company to take the following steps:

- Plan for and implement meaningful energy-efficiency efforts. Currently the Company has no plans past 2012 to ramp up efficiency programs.
- Actively monitor the market for wind energy purchases, new wind-plant construction and purchases from existing merchant generation.
- Acquire wind resources when cost-effective.

**Q: How should the deficiencies in OG&E's planning affect the rates allowed in this proceeding?**

A: The Commission should recognize OG&E's imprudence in resource planning and acquisition in its determination of the Company's return on equity and/or management-compensation levels. If a utility is not managing its resource planning and acquisition well, it should not be earning the return typical of well-managed utilities, and its management should not be paid as well as their peers in better-run utilities. Regulators have made this type of adjustment to reflect similar deficiencies by other utilities.

In this case, I do not recommend any such adjustment in revenue requirements. A stern admonition to the Company may be sufficient to change its behavior, especially if the Commission warns OG&E that financial consequences will follow if the Company does not improve its performance.

## III. Importance of Resource Assessment and Acquisition

### *A. General Considerations*

**Q: Why should utilities continually review the availability and costs of resources?**

A: Two basic considerations motivate continual review of resource options. First, there are opportunities for acquiring resources at costs low enough to reduce customer bills. For OG&E, both energy efficiency and wind energy currently meet this standard.

Second, various events can occur that would significantly change a utility's projected load-resource balance that would require rapid acquisition of new resources. These conditions include the announcements of large new loads, complete failure of a major generating unit, and emergence of problems with existing resources requiring shutdown, unit restriction or expensive investments.

### *B. Challenges Facing Company Generators*

**Q: What operating issues do OG&E's generators face over the next few years?**

A: All thermal generation units face normal operating risks, including failures of boilers, turbines and generators, sometimes with catastrophic consequences beyond the failed equipment, as when pieces of a disintegrating turbine damage other parts of the plant. These problems can strike a plant of any age, although risks may increase with age. Any utility, including OG&E, may suddenly face a decision about whether to invest in repairing a failed unit (and making other required upgrades), or to retire or mothball the unit and replace it with other resources. The better OG&E's information about the markets and its resource options, the faster and better the resulting decisions about responding to equipment failure.

**Q: Has OG&E factored in such operating risks?**

A: Yes. Mr. Langston (Direct at 13, ll. 2–4) testified that investments will be required to produce "longer operational lives for our existing generation facilities." Oddly enough, the Company states it has no cost-effectiveness or cost-benefit analyses of those expenditures (IR Sierra 2-26).

**Q: Does OG&E face any particular issues with respect to its fossil power-plant fleet at this time?**

A: Yes. A number of environmental considerations are converging that may increase the costs of continuing to operate OG&E's fossil generation, particularly the coal units. As Mr. Langston says (Direct at 12, ll. 23–24) "Environmental policy and related state and federal mandates represent critical challenges to OG&E's ability to serve its customers…." While the Company's ability to serve its customers can hardly be considered to be at risk, the cost of serving customers will vary, depending on how well OG&E prepares for and reacts to developing requirements.

### *1. Regional Haze Rule*

**Q: What OG&E plants are subject to retrofit requirements under the Regional Haze Rule?**

A: The Oklahoma Department of Environmental Quality issued a State Implementation Plan under the Haze Rule on February 2, 2010, requiring the following controls on Company plants:[1]

- installation of low-$NO_X$ burners, over-fired air, and flue-gas recirculation on Seminole Units 1, 2, and 3, at a capital cost of $26 million;
- installation of low-$NO_X$ burners and over-fired air on Sooner Units 1 and 2, at a capital cost of $14 million;
- installation of low-$NO_X$ burners and over-fired air on Muskogee 4 and 5, at a capital cost of $14 million;

These measures were accepted by OG&E in an agreement with the DEQ in February 2010.

On March 22, 2011, the U.S. EPA accepted most of these determinations, but also proposed to require flue-gas desulfurization (scrubbers) for Muskogee 4 and 5 and Sooner 1 and 2. The EPA estimates that the overnight cost of the scrubbers, in the standard analytical framework used in comparing control cost-effectiveness between options, to be $299 million for Sooner and $307 million for Muskogee, while OG&E estimates the nominal costs for completion in 2014

[1] Kordzi, J., et al, Technical Support Document for the Oklahoma Regional Haze State Implementation Plan and Federal Implementation Plan, March 2011, at 40–42.

or 2015 to be $585 million for Sooner and $634 million for Muskogee. More than half the difference in these estimates is due to the OG&E's inclusion in its estimates of total ratemaking costs factors (escalation, AFUDC and higher contingency), which are excluded from the EPA's standard cost-comparison methodology.

**Q: What is the time frame for determining the requirements for the Sooner and Muskogee scrubbers, and for OG&E's compliance?**

A: The EPA has a deadline of December 13, 2011, for finalizing the Oklahoma compliance plan. The EPA has proposed that the installation of the scrubber or conversion to natural gas (which would reduce sulfur emissions even further) be required by December 2014, although EPA is considering compliance dates from December 2013 through December 2016 (76 FR 16170).

### *2. Cross-State Air-Pollution Rule*

**Q: What is the Cross-State Air-Pollution Rule?**

A: The Cross-State Air-Pollution Rule limits various combinations of pollutants in 27 states. The portion of the rule applicable to Oklahoma is a proposed limit on state-wide power-plant $NO_X$ emissions during the summer ozone season of May to September, with full trading of emissions in 2012 and 2013, followed by full intrastate trading and limited interstate trading from 2014 on.

**Q: Which OG&E units would be affected by the Cross-State Air Pollution Rule?**

A: All of the Company's fossil units, other than six small combustion turbines, would be affected by the $NO_X$ limits. The 2010 emissions and proposed $NO_X$ allocations of specific OG&E units are summarized in Table 1.[2]

**Table 1: OG&E Ozone-Season $NO_X$ Allocations** (tons)

| Plant and Unit | Type | 2010 Emissions | 2012 Allocation | Change |
|---|---|---|---|---|
| *Horseshoe Lake–6* | Gas | 397 | 210 | −47% |
| *Horseshoe Lake–7* | CC | 300 | 309 | 3% |
| *Horseshoe Lake–8* | Gas | 427 | 411 | −4% |
| *Horseshoe Lake–9* | CT | 2 | 7 | 274% |
| *Horseshoe Lake–10* | CT | 10 | 10 | −2% |
| *McClain* | CC | 141 | 153 | 9% |
| *Muskogee-3* | Gas | | 110 | |
| *Muskogee-3* | Coal | 2,460 | 1,244 | −49% |
| *Muskogee-3* | Coal | 2,429 | 1,292 | −47% |
| *Muskogee-6* | Coal | 2,509 | 1,180 | −53% |
| *Mustang-1* | Gas | 49 | 22 | −55% |
| *Mustang-2* | Gas | 38 | 22 | −43% |
| *Mustang-3* | Gas | 185 | 125 | −33% |
| *Mustang-4* | Gas | 397 | 279 | −30% |
| *Mustang-5A* | CT | | 4 | |
| *Mustang-5B* | CT | | 4 | |
| *Redbud* | CC | 103 | 120 | 16% |
| *Seminole-1* | Gas | 512 | 497 | −3% |
| *Seminole-2* | Gas | 507 | 512 | 1% |
| *Seminole-3* | Gas | 518 | 509 | −2% |
| *Sooner-1* | Coal | 2,407 | 1,347 | −44% |
| *Sooner-2* | Coal | 2,190 | 1,229 | −44% |
| *Total* | | 15,583 | 9,596 | −38% |

While some gas steam units have allocations substantially below their past emissions in percentage, the vast bulk of the required tonnage reduction is due to the six coal units.

[2]Muskogee 3 is retired, and Mustang 5A and 5B operate rarely, so these units had no 2010 emissions.

**Q: What measures might be necessary to bring OG&E's generation fleet into compliance with the Cross-State Air-Pollution Rule?**

A: It appears that OG&E will need to undertake some combination of the following measures:

- move up the installation of low-$NO_X$ burners required under the Regional Haze rule for Muskogee 4 and 5 and Sooner 1 and 2,
- add low-$NO_X$ burners for Muskogee 6,
- purchase allowances,
- restrict the operation of the coal plants during the ozone season, such as by dispatching the combined-cycle units as baseload and cycling the coal units.

Allowances are likely to be expensive. Evolution Markets reports that seasonal $NO_X$ allowances are trading for around $2,000/ton. At that price, meeting OG&E's allowance shortfall would cost about $6 million annually. Starting in 2014, the supply of in-state allowances may be inadequate, pushing allowance prices much higher, if they are available at all. While reducing dispatch of coal units should not affect reliability, it may substantially increase energy costs.

### *3. Hazardous Air Pollutants*

**Q: What controls would be required by the EPA's pending rules for hazardous air pollutants?**

A: In March 2011, in response to a 2008 court order, the EPA promulgated rules that would require Maximum Achievable Control Technology to limit emissions of acid gases ($SO_2$, HCl, HF), mercury, arsenic, chromium, nickel, and other toxics from coal- and oil-fired plants. The EPA is obligated to issue final standards by November 16, 2011.

**Q: What OG&E plants are affected by the EPA's pending rules for hazardous air pollutants?**

A: All five coal units at Muskogee and Sooner would be subject to regulation.

**Q: What controls might be required to meet Maximum Achievable Control Technology–requirements?**

A: Any coal unit not already scrubbed to comply with the Haze Rule would probably need to add a scrubber to control acid gases. (Muskogee 6 is not subject to the Haze Rule.) In addition, all six units are likely to need to add sorbent injection to adsorb mercury, as well as fabric filters (also called baghouses) to capture the mercury-sorbent combination and other metal-bearing particles.

**Q: When would OG&E need to add these controls?**

A: Compliance would be required within seven years, by late 2018.

### *4. Coal-Combustion Residuals*

**Q: What are coal combustion residuals?**

A: Coal-combustion residuals comprise coal ash and scrubber waste.

**Q: What rules has EPA proposed regarding coal-combustion residuals?**

A: In June 2010, EPA proposed two alternative rules that would regulate coal-combustion residuals under different parts of the Resource Conservation and Recovery Act, requiring different levels of liners for surface impoundments and landfills, ground-water monitoring, and other measures.

**Q: How much might those rules cost OG&E's coal units?**

A: The North American Electric Reliability Corporation estimated costs of $30 million per unit to convert ash management from ponds to dry handling systems,

$80 million per unit for waste-water treatment at about half the affected plants, plus $15–$37.50/ton for handling of the ash and/or scrubber sludge.[3]

### 5. *Cooling Systems*

**Q: What limitations has the EPA proposed for power-plant cooling systems?**

A: In April 2011, the EPA proposed that plants using once-through cooling systems be required to limit the number of fish and other organisms trapped against their intake screens (impingement) by installing improved screens and that large plants be required to study whether additional controls are required to reduce the number of organisms that are sucked into the cooling system (entrainment).

**Q: Which OG&E units are subject to additional costs from the cooling-system rules?**

A: While Muskogee 4–6 have closed-cycle cooling systems, Sooner 1 and 2 currently use once-through cooling and are likely to require upgraded screens to limit fish impingement and may need to study entrainment levels, which may result in a requirement for cooling towers. The gas steam units at Horseshoe Lake and Seminole may also need to upgrade their screens.

**Q: What is the schedule for final cooling-system rules?**

A: Under a 2010 settlement, the EPA is required to issue final rules by July 2012.

**Q: What might compliance with the cooling-system rules cost?**

A: The screens required to meet the impingement requirements might cost $7–$10 million per unit, while cooling towers, if those are required to reduce entrain-

[3] "2010 Special Reliability Scenario Assessment: Resource Adequacy Impacts of Potential U.S. Environmental Regulations," October 2010.

ment, might cost about $60 million per unit, as well as imposing additional operating costs and reducing power plant output and efficiency.

## IV. Clean Resource Potential

### *A. Energy Efficiency*

**Q: How much energy and capacity could OG&E save through an aggressive energy-efficiency program?**

A: As discussed in detail in the testimony of Sierra Club Witness John Plunkett, were OG&E to ramp up its efficiency program to the savings achieved by the leading utilities, it could save about 3,700 GWh annually. For comparison, the OG&E coal units each generate about 3,000 GWh annually, and the Seminole gas units each generate about 1,000 GWh annually.

These savings would reduce peak demand by nearly 800 MW. Included avoided reserves, the efficiency programs would reduce the need for capacity by about 900 MW. For comparison, OG&E units at the coal plants and at Seminole are about 500 MW each, while the capacities of the other gas-fired plants range from 380 MW for Horseshoe Lake 8, down to 50 MW for Mustang 1 and 2.

**Q: What would those savings cost?**

A: As documented by Mr. Plunkett, savings at the level of leading states would cost about 5¢/kWh.

**Q: What would those savings cost?**

A: As explained by Mr. Plunkett, the savings would cost about $55/MWh.

**Q: What would be the benefits of enhanced energy-efficiency efforts?**

A: Energy efficiency avoids at least the following three types of costs:

- production costs, consisting of fuel, variable O&M, and economy wholesale energy transactions,[4]
- generation capacity costs,
- transmission-and-distribution investments.

In addition, reduced loads may allow OG&E to avoid environmental investments by reducing usage of fossil units (which ease compliance with the Cross-State Air Pollution Rule) or retiring some units (avoiding all retrofits, as well as maintenance).

According to OG&E, "Cost effective energy efficiency programs reduce customers load requirements which will reduce the amount of supply side additions necessary to meet customer load and reserve requirements" (IR Sierra 2-33).

**Q: What might be the value of these three avoided-cost components?**

A: I estimated avoided production costs from IR Sierra 2-5 Attachment 5, which presents (among other things) OG&E's forecast of the annual production cost savings from the Crossroads wind farm, as estimated by OG&E in 2010. Real-levelized over 15 years starting with 2013, the estimated Crossroads avoided cost was about $64/kW.

Avoided production costs from efficiency would be greater than those of Crossroads, for two reasons. First, the load shape for retail use, and of average energy-efficiency savings, is more heavily weighted to the high-price hours in the summer on-peak period, while the output of a wind farm is typically higher

[4] Reducing OG&E's energy use would, in various hours, allow OG&E to avoid economy purchases and, in other hours, increase off-system sales. Similarly, reduced usage would allow OG&E to purchase fewer emissions allowances or sell more allowances, depending on its situation each year.

in the off-peak and in the non-summer months.[5] Energy costs are about 40% higher in the on-peak than in the off-peak hours, and about 70% higher in the summer on-peak, when loads are greatest, than in the spring off-peak, when wind generation is at its peak. Accounting for the differences in the time patterns, I estimate that the average production costs avoided by end-use energy efficiency would be at least 10% greater than the costs avoided by a wind plant.

Second, Crossroads would deliver energy to the transmission system in western Oklahoma and must be transmitted across the state, transformed in multiple steps, and distributed to customers. By contrast energy efficiency reduces requirements at the end use, avoiding losses on the transmission system, substations, distribution lines and line transformers. The Company's average losses are 7% or 8%; since line losses increase with the square of load, the marginal losses must be greater, probably around 12%.

The Crossroads avoided production costs, with these two adjustments, are shown in Table 2, both in nominal dollars and deflated to 2012 dollars, using the 2.5% inflation rate assumed in IR Sierra 2-5 Attachment 5.

[5]Charles River Associates. 2010. "SPP WITF Wind Integration Study Final Report" CRA Project No. D14422. Boston: Charles River Associates. Figure 3.2-6

**Table 2: Avoided Production Costs** (Dollars per MWh)

| | Avoided Cost | |
|---|---|---|
| | Nominal | 2012$ |
| *2012* | $55 | $55 |
| *2013* | $63 | $62 |
| *2014* | $71 | $68 |
| *2015* | $80 | $74 |
| *2016* | $87 | $79 |
| *2017* | $94 | $83 |
| *2018* | $106 | $91 |
| *2019* | $104 | $87 |
| *2020* | $115 | $95 |
| *2021* | $113 | $91 |
| *2022* | $102 | $79 |
| *2023* | $89 | $68 |
| *2024* | $97 | $72 |
| *2025* | $111 | $80 |
| *2026* | $118 | $84 |
| *2027* | $128 | $88 |
| *2028* | $128 | $86 |
| *2029* | $148 | $97 |
| *2030* | $155 | $100 |
| *2031* | $157 | $98 |
| *2032* | $186 | $113 |
| *2033* | $180 | $107 |
| *2034* | $211 | $123 |
| *2035* | $198 | $112 |
| *2036* | $196 | $108 |

For measures installed in late 2012, with savings starting in 2013, using the 8.66% discount rate used in IR Sierra 2-5 Attachment 5, the levelized avoided costs would be as shown in Table 3.

**Table 3: Levelized Avoided Production Costs** (Dollars per MWh)

| Years | Nominal | 2012$ |
|---|---|---|
| *10* | $89.74 | $79.47 |
| *15* | $93.32 | $79.08 |
| *20* | $100.49 | $82.01 |

**Q: Are there factors that would increase today's estimates of avoided production costs compared to OG&E's estimates for Crossroads?**

A: Yes. In addition to the likelihood that the adjustments I made above were conservative, the costs of running various environmental controls and allowances required by the regulations discussed in Section III.B would increase variable O&M.

**Q: Would energy efficiency avoid costs other than the productions costs modeled in the Crossroads analysis?**

A: Yes. While the Crossroads analysis excludes any capacity-related benefits, energy-efficiency programs reduce peak loads, reducing generation capacity requirements. Lower loads would allow OG&E to sell peaking capacity to other utilities, retire or mothball existing units, and defer new capacity, which the 2011 IRP (at 42) projects will be needed in 2022. Assuming a short-term capacity value of $15/kW-year in 2013 dollars, and avoidance of conventional peaking capacity in 2022 at the $974/kW capital cost in the IRP (at 42), a 10% carrying cost including O&M, 15% avoided peak losses, 13.6% required reserves, and a 54% load factor, the levelized avoided cost of generation would be as shown in Table 4.

**Table 4: Levelized Avoided Generation Cost** (Dollars per MWh)

| Years | Nominal | 2012$ |
|---|---|---|
| *10* | $6.95 | $5.89 |
| *15* | $13.36 | $11.32 |
| *20* | $16.43 | $13.92 |

This estimate of avoided capacity costs is considerably less than OG&E's estimate of $88/kW-year (or about $19/MWh) in 2012, rising to $171-kW-year ($36/MWh) in 2020 (IR AARP 4-9).

In addition, the peak load reductions from energy-efficiency programs reduce the need for investments in transmission and distribution capacity.

Assuming a modest $50/kW-year avoided T&D cost (lower than most estimates I have seen), the avoided T&D cost would be about $14/MWh in nominally-levelized terms or $12/MWh in real-levelized terms.

Mr. Plunkett uses these estimates of avoided costs in his analysis.

### *B. Wind Generation*

**Q: How much wind generation can be developed in Oklahoma and adjacent areas?**

A: Oklahoma and other parts of the Southwest Power Pool have enormous potential for wind-farm development. As of May 2011, in addition to over 4,000 MW of wind in service, the Pool had approved Generation Interconnection Agreements with 66 wind projects totaling 12,122 MW. These comprise the following:

- Forty-four active agreements totaling 8,442 MW;
- Sixteen agreements with deadlines suspended by the developers, totaling 3,180 MW;
- Six operating projects with 500 MW of additional approved capacity.

Another 77 wind projects totaling 13,517 MW were in the Pool's interconnection queue.[6]

By September 2011, 64 wind projects were on line in the Southwest Power Pool, with a total of 4,485 MW.[7]

A study for the Pool found, "there are no significant technical barriers to integrating wind generation to a 20% penetration level into the SPP system,

[6] Second Status Report of Southwest Power Pool, Inc., In Response to Order on Interconnection Queue Reform, FERC Docket No. ER09-1254-000, August 1, 2011, at. 2–3.

[7] Monthly State of the Market Report for September 2011, SPP Market Monitoring Unit, October 17, 2011, at. 12.

provided that sufficient transmission is built" (at 1-5).[8] That penetration level is defined as 20% of total energy requirement, or 46,700 GWh from 13,674 MW of wind farms (at 3-10, 3-11). The same study reviewed the effects of increasing wind generation to 40% of the Pool's energy requirement (about 25,000 MW of wind capacity, producing 86,000 GWh) and identified no specific problems, although the analysis was more limited that for the 20% case.

Of this tremendous potential, OG&E owns 449 MW of wind (120-MW Centennial and 101-MW OU Spirit in service, with 198-MW Crossroads scheduled for completion in 2012) and has another 332 MW under contract (50-MW FPL Sooner and 152-MW Keenan in service, and 130-MW Taloga completed in 2011). Wind supplied only about 3% of OG&E's energy (about 940 GWh) in 2010.[9] With the addition of 328 MW of Crossroads and Taloga and a full year's operation of Keenan (which entered service in 2010), assuming a 40% capacity factor, OG&E's wind output would rise to about 2,700 GWh, or nearly 9% of energy requirements.

**Q: Can you estimate wind energy costs?**

A: Yes. In 2007 through 2010, OG&E paid about $25/MWh for energy from the FPL Sooner project; in 2010, OG&E paid about $47/MWh for Keenan.[10]

Similarly low costs for wind projects have been reported in other parts of the Great Plains. Minnesota Power has recently estimated that its latest wind project, Bison 3, will cost $28/MWh, or $47/MWh before the federal production

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[8]Charles River Associates. 2010. "SPP WITF Wind Integration Study Final Report" CRA Project No. D14422. Boston: Charles River Associates.

[9]OG&E 2011 Integrated Resource Plan, pp. 11–12; Appendix D, at 9.

[10]Keenan is one of the most expensive regional wind plants in recent years, at about $2,100/kW.

tax credit.[11] Kansas City Power & Light has contracted with Duke for $38/MWh from the Cimarron II wind farm.[12]

The relatively low cost of recent projects is largely attributed to "a drop in the price of turbines" (Megawatt Daily, op. cit.). Indeed, turbine prices are reported to have declined by $500–$1,000/kW compared to the past few years (Power Finance & Risk, op. cit.).

Most of the wind farms in the Great Plains for which I have found public cost data cost less than Crossroads, as follows:[13]

- Spearville (Kans.): $261 million for 148.5 MW, or $1,759/kW.
- Central Plains (Kans.): $181 million for 99 MW, or $1,830/kW.
- Flat Ridge 1 (Kans.): $191 million for 100 MW, or $1,905/kW.
- Flat Ridge 2 (Kans.): $800 million for 419 MW, or $1,905/kW.
- Caney River (Kans.): $350 million for 200 MW, or $1,750/kW.
- Ainsworth (Neb.): $81.3 million for 50 MW, or $1,626/kW.
- Bison 1–3 (N.D.): $492 million for 286 MW, or $1,721/kW.[14]
- Rocky Ridge (Okla.): $250 million for 150 MW, or $1,667/kW.

A large amount of additional wind capacity is likely to be available at similarly attractive costs, especially as turbine technology improves and production capacity increases.

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[11] "Wind project to Cut Overall Costs in Minnesota," Megawatt Daily, October 21, 2011, at 10.

[12] "Wind Turbine Glut, Greater Efficiency Drive Down Prices," Power Finance & Risk, 9/5/2011, at 1.

[13] The first three projects' costs are from the owners' FERC Forms 1; the remainder are from web reports.

[14] The more recently ordered phases 2 and 3 have reported costs of $1,495/kW, which is $750/kW less than phase 1, consistent with the downward trend in turbine price.

**Q: Are wind additions cost-effective for OG&E?**

A: That is certainly OG&E's position. In Chart 2 of his direct testimony, OG&E Witness Jesse Langston lists the net benefits of OG&E's three wind farms and its two wind-energy purchase agreements (WEPAS). These benefits are listed in Table 5. The net present values in Table 5 are from Langston's Chart 2, while the Centennial and Spirit capital costs are from OG&E's FERC Form 1 at 337; the Crossroads costs are from press reports.[15]

**Table 5: Summary of OG&E Wind Project Benefits**

| Wind Project | In-Service Date | MW | Net Present Value Millions | Net Present Value $/kW | Capital Cost $/kW |
|---|---|---|---|---|---|
| *Centennial* | 2007 | 120 | $147.3 | $1,228 | $1,578 |
| *OU Spirit* | 2009 | 101 | $160.5 | $1,589 | $2,488 |
| *WEPAs* | 2010 | 278 | $308.2 | $1,109 | |
| *Crossroads* | 2011 | 228 | $453.1 | $1,992 | $1,982 |
| *Total* | | 727 | $1,069.1 | $1,472 | |

The net benefits begin quite soon. "Beginning in 2013 or 2014, the lower-cost energy produced by Crossroads is expected to result in a net decrease in average monthly residential electric bills and to reduce customer bills each year the wind farm is in operation."[16]

In its 2011 Integrated Resource Plan, OG&E estimates that the energy-cost savings from 250 MW of generic wind additions displacing its current marginal energy supplies—a mix of coal and gas—would have a present value of about $650 million, or $2,600/kW (OG&E IRP, May 2011, at 32). Production tax credits, if extended, would provide benefits of another $840/kW, for a total of about $3,440/kW. In the cost-benefit analysis for Crossroads, OG&E estimated

[15] E.g., "OG&E Completes Crossroads Wind Farm Development Purchase," Reuters, 8/9/2010.

[16] "OG&E's 'Crossroads' Wind Farm Gains Regulatory Approval; Low cost energy will reduce customer bills," OG&E press release, July 29, 2010.

the present-value benefits at $2,900/kW in production costs and $1,100/kW in production tax credits, a total of $4,000/kW (IR Sierra 2-5 Attachment 5).[17]

These estimates of benefits include only production-cost savings. Those production-cost benefits would be greater if the capacity of fossil generation is limited temporarily by emission limits, if emission credits are expensive, or if environmental controls reduce the net capacity or availability of some fossil units, especially the baseload coal units. Any capacity value attributed to wind generation, and any contribution to avoiding the environmental compliance costs of OG&E's fossil plants, would further increase the benefits.

### *C. Existing Gas Resources*

**Q: What efficient gas resources are available in the Southwest Power Pool and surrounding areas?**

A: I have identified approximately 6,900 MW of combined-cycle capacity owned by merchant generators in the Pool and well-interconnected neighboring Entergy Arkansas territory. See Table 6 below.[18] This capacity is generally not committed to serving load, and is sold in the spot market or under short-term contracts.

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[17] In its response to IR Sierra 2-5, OG&E does not provide the same level of detail for its present-value estimates for its other wind farms.

[18] The first four plants, Oneta, Dogwood, Eastman, and Green Country (along with the Harrison plant that was sold to Texas coops in December 2010) are listed as being available to meet generation shortfalls in the modeling used to develop the Southwest Power Pool's 2010 Transmission Expansion Plan. The three Arkansas plants are in the Entergy control area, geographically and electrically adjacent to the Pool.

**Table 6: Merchant Combined-Cycle Capacity in SPP and Entergy's Arkansas Territory**

| *Plant/Owner* | State | Summer Net MW | 2009 Capacity Factor |
|---|---|---|---|
| *Oneta Energy Center*[a] | | | |
| Calpine Central LP | Okla. | 886 | 32% |
| *Dogwood Energy Facility* | | | |
| Dogwood Energy LLC | Mo. | 614 | 16% |
| *Eastman Cogeneration Facility* | | | |
| Eastman Cogeneration LP | Tex. | 402 | 57% |
| *Green Country Energy LLC (b)* | | | |
| Green Country Op Services LLC | Ola. | 263 | 55% |
| *Evangeline Power Station* | | | |
| Cleco Evangeline LLC | La. | 732 | 32% |
| *Kiamichi Energy Facility* | | | |
| Kiowa Power Partners LLC | Okla. | 1,178 | 51% |
| *Pine Bluff Energy Center* | | | |
| Pine Bluff Energy LLC | Ark. | 192 | 80% |
| *Union Power Partners LP* | | | |
| Union Power Partners LP | Ark. | 2,020 | 24% |
| *Hot Spring Power Project* | | | |
| Hot Spring Power Co LLC | Ark. | 642 | 49% |
| *TOTAL* | | 6,929 | 37% |

[a]The 886 MW at Oneta Energy Center is net of the new seven-year 200 MW PPA with Xcel Energy's Southwestern Public Service Company, reported in Calpine's 2010 Annual Report.

[b]The 263 MW at Green Country Energy is net of the 520 MW PPA with Public Service Company of Oklahoma which will be in effect from June 2012 through February 2022. (Exelon 10-K at 295)

In addition to the combined-cycle capacity, merchant generators also own some 826 MW of modern combustion turbine capacity in Louisiana and Missouri that may be available to provide OG&E with peaking energy and reserve capacity, with efficiency on a par with gas steam plants.

**Q: What might those resources cost, were OG&E to acquire them?**

A: A number of merchant combined-cycle gas plants have sold in recent years, as shown below in Table 7. These earlier sales provide some indication of the market value of combined cycle plants.

1 **Table 7: Sales of Combined-Cycle Plants In and Around the Southwest Power Pool**

| Seller | Plant Name | State | Closing Date | Pct. Sold | Capacity (MW)[a] | Acquirer | Purchase Price $M | Purchase Price $/kW |
|---|---|---|---|---|---|---|---|---|
| *NRG Energy* | McClain | Okla. | 7/9/04 | 77% | 377 | Oklahoma G&E | $160 | $425 |
| *CLECo* | Perryville | La. | 6/30/05 | 100% | 831 | Entergy LA | $170 | $205 |
| *Central Mississippi Generating* | Attala | Miss. | 3/31/06 | 100% | 500 | Entergy MS | $88 | $176 |
| *Calpine* | Aries/Dogwood | Mo. | 2/7/07 | 100% | 677 | Kelson Energy | $234 | $345 |
| *Cogentrix Energy* | Ouachita | La. | 5/4/07 | 100% | 904 | Entergy AR | $198 | $219 |
| *Calpine* | Acadia Energy | La. | 8/17/07 | 50% | 1,376 | Cajun Gas Energy | $189 | $137 |
| *GE Energy Financial Services* | Green Country | Okla. | 10/2/07 | 100% | 904 | J-Power USA Generation | $240 | $265 |
| *Cogentrix* | Southaven Power | Miss. | 5/9/08 | 100% | 904 | TVA | $461 | $510 |
| *Kelson* | Redbud | Okla. | 9/30/08 | 100% | 1,338 | Oklahoma Gas & Electric | $852 | $637 |
| *Tennessee Valley Authority* | Southaven Power | Miss. | 10/6/08 | 70% | 633 | Seven States Power | $345 | $545 |
| *Acadia Power Partners* | Acadia 1 | La. | Feb '10 | 100% | 580 | CLECo | $304 | $524 |
| *Kelson* | Cottonwood | Texas | Aug '10 | 100% | 1,279 | NRG Energy | $525 | $410 |
| *Entergy* | Harrison | Texas | Dec '10 | 61% | 550 | East and North Texas Coops | $219 | $654 |
| *PSEG* | Odessa | Texas | 1/13/11 | 100% | 1,000 | High Plains Diversified Energy | $335 | $335 |
| *PSEG* | Gaudelupe | Texas | 1/13/11 | 100% | 1,000 | Wayzata Investment | $351 | $351 |
| *Acadia Power Partners* | Acadia 2 | La. | 4/29/11 | 100% | 580 | Entergy LA | $300 | $517 |
| *Sequent* | Wolf Hollow | Texas | 5/13/11 | 100% | 720 | Exelon | $305 | $424 |
| *Kelson* | Magnolia | Miss. | Aug '11 | 100% | 863 | Tennessee Valley Authority | $436 | $505 |
| *KGen Partners* | Hinds | Miss. | 2012 | 100% | 520 | Entergy AR | $206 | $396 |
| *KGen Partners* | Hot Spring | Ark. | 2012 | 100% | 630 | Entergy MS | $253 | $408 |

[a]Summer capacity reported by owner or EIA.

In contrast, OG&E estimates that a new gas-fired combined-cycle plant would cost $1,003/kW in 2010 dollars, plus financing costs (OG&E 2011 Integrated Resource Plan, Table 4).[19]

## V. The Company's Performance in Resource Assessment and Acquisition

**Q: How has OG&E performed in terms of resource assessment?**

A: The Company's performance has been disappointing. Although the 2011 Integrated Resource Plan says that the Company will "continue to explore demand side opportunities [and] monitor renewable resource markets" (2011 IRP at ES-2), OG&E has been passive in its approach to resource assessment.

The Company has not monitored and assessed the opportunities for expanding its energy-efficiency programs, acquiring additional wind energy, or purchasing merchant resources, as I describe below. The Company has certainly not moved forward to increase either energy-efficiency or wind resources, although both appear to be highly cost-effective under current circumstances and even more so as part of a least-cost environmental-compliance plan.

**Q: Is the IRP process sufficient to determine whether OG&E is minimizing costs for its customers?**

A: No. The IRP is a potentially useful tool for focusing OG&E's attention on the major planning issues it faces at any given time, to communicate OG&E's understanding of the planning environment to other parties, and to allow other

[19]While some of the sales in Table 7 are of plants somewhat remote from Oklahoma (geographically and/or electrically), their costs are indicative of the market value of this technology in the mid-south region. If anything, prices for power and power plants would tend to be lower in the Southwest Power Pool and the interconnected areas (as in Table 6) than in areas such as ERCOT, Louisiana, and Mississippi.

parties to respond to OG&E's perspective. Unfortunately, as implemented by OG&E, the IRP process does not allow for a deep or detailed exchange of information and analyses.

The 2011 IRP contained only a limited energy-efficiency plan, without any commitment to a long-term program, and unrealistic estimates of wind-plant costs. The IRP was filed in May, but no hearing has yet been scheduled. As I discuss below, some of the assertions in the 2011 IRP regarding OG&E's continuing planning process appear to overstate the Company's efforts to minimize customer costs.

The Company states that it has "not begun the process of developing its next integrated resource plan" and has not considered how it will consider energy-efficiency planning (IR Sierra 2-35). The completion date of the IRP has been pushed back from June to October 2012, by which time OG&E may have been forced to make important decisions on environmental compliance. Allowing the IRP schedule to limit OG&E's consideration of resource options may result in suboptimal decisions and increase costs for both continuing operations and environmental compliance.

### *A. Energy Efficiency*

**Q: How has OG&E incorporated energy efficiency into its resource plans, in terms of minimizing customer bills and minimizing the cost of responding to environmental mandates?**

A: The Company has done little, if anything, along these lines. OG&E has not projected the effects of any energy-efficiency programs beyond "the 2009 plan to invest during the years 2010, 2011, and 2012" (2011 IRP, at 17). While "OG&E plans to file a new comprehensive 3-year Demand Program offering during June 2012" (ibid.), it has no plans beyond 2012 (IR Sierra 2-27, 2-28), and has not even "begun the process of developing its next integrated resource plan that will be complete October 1, 2012" (IR Sierra 2-35).

The Company has left significant cost-effective energy savings untapped as a result of its limited program designs and planning scope, and done almost nothing to build OG&E's capability to reduce customer bills.

### *B. Wind Resources*

**Q: How has OG&E responded to the overwhelmingly positive economics of its past wind projects, as you discuss above in Section IV.B?**

A: Although the Company has made some significant commitments to adding wind capacity in its system in recent years, the company in its most recent IRP seems to have arbitrarily limited its exploitation of this resource and has not aggressively pursued acquisition of economic wind generation. Strangely, given the stellar results OG&E reports in Mr. Langston's Chart 2, OG&E does not appear to be doing anything to further increase the contribution of wind generation to reducing its costs.

**Q: Why is OG&E not proceeding to maximize the benefits of wind energy for its customers?**

A: The Company has not explained its failure to pursue this resource beyond the acquisition of Crossroads. The best hint to OG&E's cautious approach may lie in the Company's 2011 Integrated Resource Plan.

The IRP relies on generic estimates of the costs of new wind plants, from an October 2010 report by R.W. Beck for the Energy Information Administration[20]

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[20]Hahn, V., et al, EOP III Task 1606, Subtask 3: Review of Power Plant Cost and Performance Assumptions for NEMS, Technology Documentation Report, R. W. Beck and Science Applications International Corporation, October 2010.

(OG&E IRP, May 2011, at 18, 28, 47). That report, which cites no actual plant costs, estimates that a 100-MW farm of 1.5-MW turbines would cost $2,438/kW in 2010 overnight costs, plus an unspecified amount of AFUDC. This price, which is 21% higher than the EIA's estimate for the 2010 Annual Energy Outlook, appears to be overstated, given improvements in technology, increased turbine production, and reduced global demand for turbines.[21] Beck's estimate is also much greater than the $1,700–$2,000/kW range of the existing wind farms and those under construction that I discuss in Section IV.B.

The IRP further estimates that the NPV of the capital and operating costs of generic new wind would be $3,200/kW (IRP at 32), 50% more than the $2,400/kW that OG&E estimated for Crossroads (IR Sierra 2-5 Attachment 5). The IRP estimate of the present-value cost of the generic wind farm is greater than the estimated production-cost benefits in either the IRP (at 32) or the Crossroads analysis (IR Sierra 2-5 at Attachment 5). However the present-value costs for Crossroads are lower than the production-cost benefits in either analysis.

The Company it its IRP further assumes that the production tax credit will not be extended.[22] Combined with high estimated costs and low forecast production-cost benefits, the omission of the tax credit leads to the statement in the Action Plan that "OG&E has made no decision whether to issue a RFP to additional wind resources but will continue to monitor the market for renewable projects that benefit customers while contributing to the State's renewable energy goal" (IRP at 45).

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[21]For example, Beck assumes 1.5-MW units. These would be at the small end of the range for recent and planned wind farms, which often use 2.3-MW or even 3-MW turbines.

[22]The production tax credit has been extended four times since it was first enacted in 1992; over the 21 years from 1992 to 2012, the credit has been in place for all but 3 years.

**Q: Have you seen any explanation from OG&E of why it used the RW Beck wind-farm costs, rather than its own experience or current offers?**

A: No.

**Q: How has OG&E "monitored the market for renewable projects?"**

A: The Company does not appear to be monitoring the market at all. It has no documents related to "current and planned efforts to track the projected and actual costs of new wind capacity in Oklahoma and adjacent states" (IR Sierra 2-6a). Similarly, OG&E asserts that it "does not possess any information on actual construction costs of new wind capacity" (IR Sierra 2-6a). When asked to "list and describe all long-term power-purchase agreements entered into since 2000 for output from wind plants anywhere in SPP," which is one market I would expect OG&E to monitor, the Company replied that it "only has knowledge of its long term wind power purchase agreements" (IR Sierra 2-7).

According to the Company, it has received offers to sell power from wind projects and ownership in existing wind plants (IR Sierra 2-8, 2-9). Those offers are confidential and OG&E had not provided the documents as of November 4, so I have not been able to review them.[23] At this point, OG&E has made no real showing that it is monitoring the wind market.

**Q: What should OG&E be doing with respect to acquiring wind power?**

A: The Company should be continually monitoring the market and collecting information about capital costs for wind farms proposed, under construction, and in service, as well as prices for purchased power contracts from wind plants. In

[23]The response to IR Sierra 2-8 suggests that the most recent offers for the sale of unit energy and capacity are those in response to the Company's 2008 Wind RFP. Given the level of interest in wind development in the Southwest Power Pool, I would be surprised if no developer had approached OG&E since its 2008 Wind RFP.

addition, OG&E should be soliciting offers from developers and—assuming that the prices are attractive—periodically issuing RFPs for wind projects or otherwise selecting projects to acquire.

### *C. Existing Gas Resources*

**Q: Has the Company been tracking existing merchant gas generation that might be available for purchase or long-term contract?**

A: No. The Company has neglected to follow the market for existing gas generation. According to the Company, "OG&E is not aware of the current available capacity or energy from merchant combined cycle generation resources" (IR Sierra 2-13). Nor could OG&E identify non-utility combustion turbines that might have capacity available for purchase (IR Sierra 2-17). The Company could not even document any efforts it has made to identify existing merchant combined-cycle generation resources that might be available for acquisition or long-term power purchase (IR Sierra 2-14).

Some related information may be available in the confidential response to IR Sierra 2-18, which may have information on the sales prices for merchant generation, existing generation available for acquisition or for long-term contract (see IR Sierra 2-20), and the prices of power purchases (see IR Sierra 2-20). It is not clear why all such price data would be confidential, since prices are often reported in press releases, financial reports, and FERC filings.

**Q: What should OG&E do with respect to existing merchant generation?**

A: The Company should maintain a list of merchant generation that could provide energy and/or capacity to OG&E, along with at least rough estimates of costs of delivering the power to its service territory. The Company should also periodically inquire as to the owners' interest in plant sales or long-term contracts, and evaluate the net benefits of acquiring various resources.

Acquiring merchant resources may or may not be cost-effective as additions to OG&E's existing resource mix, depending on the prices requested by the current owners. The attractiveness of acquiring merchant resources would be greatly enhanced, however, were those resources part of a compliance plan that avoid major environmental retrofits and allowance purchases at existing steam plants. If OG&E does not have the necessary data, it will not be able to move expeditiously to implement a least-cost environmental compliance plan, exposing its customers to excess costs.

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

A: Yes.