**BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION**

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| **IN THE MATTER OF THE APPLICATION OF PUBLIC SERVICE COMPANY OF NEW MEXICO FOR APPROVAL TO ABANDON SAN JUAN GENERATING STATION UNITS 2 AND 3, ISSUANCE OF CERTIFICATES OF PUBLIC CONVENIENCE AND NECESSITY FOR REPLACEMENT POWER RESOURCES, ISSUANCE OF ACCOUNTING ORDERS AND DETERMINATION OF RELATED RATEMAKING PRINCIPLES AND TREATMENT,** | ) | **Case No. 13-00_____-UT** |
| **PUBLIC SERVICE COMPANY OF NEW MEXICO,** | ) | |
| **Applicant** | ) | |

# DIRECT TESTIMONY AND EXHIBITS

# OF

# PATRICK J. O'CONNELL

**December 20, 2013**

**NMPRC CASE NO. 13-00_____-UT**
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**WITNESS FOR**
**PUBLIC SERVICE COMPANY OF NEW MEXICO**

**DIRECT TESTIMONY OF**
**PATRICK J. O'CONNELL**
**NMPRC CASE NO. 13-00_____-UT**

## I. INTRODUCTION, PURPOSE AND KEY CONCLUSIONS

**Q. PLEASE STATE YOUR NAME, POSITION AND BUSINESS ADDRESS.**

A. My name is Patrick J. O'Connell. I am Director, Planning and Resources, for Public Service Company of New Mexico ("PNM" or "Company"). My address is 414 Silver Avenue, SW, Albuquerque, New Mexico 87102.

**Q. PLEASE DESCRIBE YOUR RESPONSIBILITIES AS DIRECTOR, PLANNING AND RESOURCES.**

A. I oversee PNM's Integrated Resource Planning and Energy Efficiency Design teams. The Integrated Resource Planning team is responsible for developing PNM's resource plans and the regulatory filings to support those resource plans, including PNM's Integrated Resource Plan ("IRP") that is required to be filed every three years with the New Mexico Public Regulation Commission ("Commission" or "NMPRC") under 17.7.3 NMAC ("IRP Rule"). The Energy Efficiency Design team develops PNM's energy efficiency and load management program plans and the regulatory filings to support them.

**Q. HAVE YOU PREVIOUSLY TESTIFIED IN UTILITY REGULATORY PROCEEDINGS?**

A. Yes. A list of the NMPRC proceedings in which I have either testified or filed testimony is included in the statement of my experience and qualifications that is attached to my testimony as PNM Exhibit PJO-1.

**Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY?**

A. My testimony demonstrates that the most cost-effective means of complying with the Regional Haze Rule adopted by the Environmental Protection Agency ("EPA") pursuant to the Clean Air Act is to retire Units 2 and 3 at the San Juan Generating Station ("SJGS") and install selective non-catalytic reduction technology ("SNCR") on the remaining two units in accordance with the Revised State Implementation Plan ("Revised SIP"), and replace the capacity of the retired units with a portfolio of resources that includes nuclear, natural gas, renewable generation and additional capacity in SJGS Unit 4. Specifically, I will:

- Describe the costs and benefits to PNM's customers of complying with the Revised SIP as opposed to complying with the Federal Implementation Plan ("FIP") adopted by the U.S. Environmental Protection Agency ("EPA");
- Describe how PNM used the IRP process to obtain public input on the plant retirements and additions proposed in this filing and how it will use the ongoing IRP process to help refine the selection of resource additions for which PNM will seek Commission approval in the future; and
- Describe why it is in the public interest to approve the plant retirements and certificates of public convenience and necessity ("CCN") for plant additions that PNM is requesting in this case.

In the course of developing these points, I will also describe how complying with the Revised SIP will affect PNM's existing generation resource portfolio and identify and compare alternative generation resource portfolios that could comply with the Regional

Haze Rule requirements at SJGS, but at higher cost than what PNM is proposing in this proceeding.

**Q. DO YOU HAVE ADDITIONAL EXHIBITS?**

A. Yes. They are as follows:

- PNM Exhibit PJO-2: Current Load and Resource Projections
- PNM Exhibit PJO-3: Summary of Regional Haze Compliant Portfolios
- PNM Exhibit PJO-4: Revised SIP Load and Resource Projections
- PNM Exhibit PJO-5: Resource Modeling Assumptions
- PNM Exhibit PJO-6: SJGS Unit 4 Additional Capacity Portfolio Comparison

**Q. PLEASE EXPLAIN THE DIFFERENCE BETWEEN THE REVISED SIP AND THE FIP.**

A. Both the Revised SIP and the FIP are implementation plans requiring SJGS to take specified actions in order to comply with the Regional Haze Rule. Both require investment in PNM's generation fleet. The Revised SIP, in comparison to the FIP, allows PNM to invest in a more balanced resource portfolio that will reduce overall costs to PNM's customers and will reduce the environmental impact of the service PNM provides. The requirements at SJGS under the Revised SIP and the FIP are summarized as follows:

- The Revised SIP requires installation of SNCR technology on SJGS Units 1 and 4 by the later of January 31, 2016, or 15 months after the Revised SIP is approved by EPA, and retirement of SJGS Units 2 and 3 by December 31, 2017.
- The FIP requires installation of selective catalytic reduction ("SCR") technology on all four units of SJGS by September 21, 2016.

The Revised SIP must be approved by the EPA before it will replace the FIP. The process that led to the two implementation plans is described in Mr. Darnell's testimony.

**Q. WHAT ARE THE PRINCIPAL CONCLUSIONS OF YOUR TESTIMONY?**

A. First, retiring SJGS Units 2 and 3 and installing SNCR technology on Units 1 and 4 in accordance with the Revised SIP, and replacing the retired capacity by adding nuclear, natural gas, renewable resources and additional capacity in SJGS Unit 4, is in PNM's customers' best interest because these actions are less costly over the 20-year planning period than installing SCR technology at SJGS, as required by the FIP. Second, the most cost-effective portfolio of resources to replace the retired coal capacity at SJGS includes the addition of 134 MW of capacity in Palo Verde Nuclear Generating Station ("PVNGS") Unit 3 at a cost of $2,500/kW. Third, this most cost-effective portfolio of resources is less risky compared to either the FIP or a portfolio that relies more heavily on gas-fired generation rather than using PVNGS Unit 3. The Revised SIP allows PNM to invest money that would be spent on SCR under the FIP on generation additions that will reduce costs in the future, reduce the risk associated with coal generation in PNM's

supply portfolio and reduce the emissions associated with generating electricity to meet customers' needs. The most cost-effective portfolio of new resources to replace Units 2 and 3 includes nuclear, solar, gas peaking resources and additional capacity in SJGS Unit 4. The investment in these replacement resources will produce lower fuel and operation and maintenance costs going forward, which reduces future costs to customers compared to compliance with the FIP. The resulting replacement resources will reduce greenhouse gas emissions without a significant increase in reliance upon natural gas generation so as to reduce the risk of cost increases associated with future environmental regulations affecting greenhouse gas emitting sources and the risk associated with price volatility of natural gas. These conclusions are based on a comprehensive analysis of various resource portfolio options using the Strategist® modeling software and other quantitative and qualitative analytic tools.

## II. PNM'S EXISTING RESOURCES

**Q. PLEASE DESCRIBE PNM'S EXISTING PORTFOLIO OF GENERATION RESOURCES.**

A. PNM provides service to its half million customers by generating electricity at PNM-owned power plants and by purchasing capacity and energy under long term power purchase agreements ("PPA"), as well as by making short term market purchases as needed. Electricity is delivered from generation resources to PNM's customers through a system of electric transmission and distribution lines. The current mix of generation resources that provides NMPRC-regulated electric service includes resources fueled by coal, nuclear and natural gas and wind and solar powered resources as

shown on Table PJO-1. In addition to the supply-side resources shown on this table, PNM reduces the need for electric generation using demand-side resources such as energy efficiency and load management programs. Other PNM programs and tariffs encourage PNM customers to install solar photovoltaic ("PV") systems behind their meters, which reduce the amount of electricity PNM generates to serve its customers. Presently, over 3,800 PV systems are in place.

**Table PJO-1**
**PNM's Existing Generation Resources**

| Resources | Fuel Type | PNM Share | PNM Share of Capacity (MW's) | In-Service Date | Operating Agent |
|---|---|---|---|---|---|
| San Juan | Coal | 46.4 % | 783 | 1973-1982 | PNM |
| Palo Verde Units 1 & 2 | Nuclear | 10.2 % | 268 | 1985-1986 | APS |
| Four Corners Units 4 & 5 | Coal | 13 % | 200 | 1969-1970 | APS |
| Afton | Natural Gas | 100 % | 230 | 2002 | PNM |
| Reeves | Natural Gas | 100 % | 154 | 1958-1962 | PNM |
| Lordsburg | Natural Gas | 100 % | 80 | 2002 | PNM |
| Luna Energy Facility | Natural Gas | 33.3 % | 185 | 2006 | PNM |
| Delta (PPA) | Natural Gas | N/A | 138 | 2001 | Delta-Person LP |
| Valencia (PPA) | Natural Gas | N/A | 145 | 2008 | SWG Valencia Power LLC |
| NMWEC (PPA) | Wind | N/A | 204 | 2003 | NextEra Resources |
| PNM Solar PV | Solar | 100 % | 22.5 | 2011 | PNM |
| PNM Solar PV | Solar | 100 % | 21.5 | 2013 | PNM |
| Lightning Dock | Geothermal | 100% | 10 | 2014 | Cyrc LLC |
| **TOTAL** | | | **2,441** | | |

**Q. DOES PNM HAVE APPLICATIONS PENDING AT THE COMMISSION TO ACQUIRE GENERATION RESOURCES IN ADDITION TO THE RESOURCES REQUESTED IN THIS CASE?**

A. Yes. PNM has requested approval to construct an additional 23 MW of solar PV capacity at various New Mexico locations and to purchase the full output of the Red Mesa Wind facility, a 102 MW wind facility located in Cibola County, New Mexico. If approved, these resources will provide electricity to PNM's customers by January 1, 2015. Also pending before the Commission is PNM's request for a CCN for the La Luz Energy Center, a 40 MW natural gas peaking plant that PNM intends to construct in Valencia County, New Mexico, and bring on line before the 2016 summer peak. For resource planning purposes I have assumed that these applications will be granted. The need for these resources is not related to or affected by the retirement of SJGS Units 2 and 3.

**Q. EXCEPT FOR THE RETIREMENT OF SJGS UNITS 2 AND 3 AS REQUESTED IN THIS CASE, DID PNM ASSUME THAT ALL EXISTING RESOURCES WILL BE AVAILABLE THROUGH THE 20-YEAR PLANNING PERIOD?**

A. Yes. As discussed in Mr. Horn's testimony, PNM will renew or purchase ownership of the leased portions of its interest in PVNGS Units 1 and 2 at the end of the initial or extended lease terms, which will occur during the 20-year planning period. PNM has obtained Commission approval to purchase Delta, so that resource is modeled as an owned resource that remains in PNM's portfolio through the planning period. The New

Mexico Wind Energy Center PPA and the Valencia PPA both expire in 2028, within the 20-year planning period, but, for resource modeling, I am assuming in all scenarios that these resources remain in PNM's portfolio. Similarly, PNM's demand response program contracts expire prior to the summer peak in 2017, but I am assuming the DR resources remain or are replaced with something similar in PNM's portfolio. However, before the PPAs and demand response contracts expire, PNM will evaluate the most cost effective alternative and will only renew a PPA if the terms and conditions are better than any available alternative.

**Q. PLEASE DESCRIBE SJGS'S CONTRIBUTION TO PNM'S EXISTING GENERATION PORTFOLIO.**

A. SJGS provides the most capacity and energy of any of PNM's supply resources. It provides approximately 34% of PNM's capacity to meet summer peak demand as shown in PNM Exhibit PJO-2, PNM's current load and resource table. SJGS supplies approximately 50.1% of the energy to serve PNM's retail customers. PNM's next largest jurisdictional resources, PVNGS Units 1 and 2, provide approximately 12% of PNM's capacity and 20% of the energy to serve PNM's retail customers. SJGS is an economic base load generation resource providing both capacity and energy used to provide reliable, cost-effective customer service.

## III. COMPARISON OF POTENTIAL RESOURCE PORTFOLIOS TO COMPLY WITH THE REGIONAL HAZE RULE

**Q. PLEASE DESCRIBE THE PURPOSE OF THIS PART OF YOUR TESTIMONY.**

A. In this part of my testimony I will show that the Revised SIP and a combination of nuclear, gas, renewable resources and additional capacity in SJGS Unit 4 results in the most cost-effective resource portfolio for PNM's customers. The analysis is based on a comparison of estimated utility costs over a twenty year period. Another consideration in the analysis is the risk that actual costs over the planning period will vary significantly from the projections used in the modeling. Consequently, I will compare different resource portfolios to show their potential to minimize the risk that future costs could be significantly different than estimated today due to volatile natural gas prices and a range of future costs associated with anticipated environmental regulation. I will compare four resource portfolios that would meet the requirements of the Regional Haze Rule and enable PNM to maintain reliable electric service. The four portfolios are presented in PNM Exhibit PJO-3 and are described as follows:

- Comply with the Regional Haze Rule as required by the Revised SIP by installing SNCR on SJGS Units 1 and 4, retiring Units 2 and 3, and replacing the retired capacity with a mix of resources including PVNGS Unit 3, new solar generation, a gas peaking plant and additional capacity in SJGS Unit 4;
- Comply with the Regional Haze Rule as required by the Revised SIP by installing SNCR on SJGS Units 1 and 4, retiring Units 2 and 3, and replacing the retired

capacity with new solar generation, gas peaking capacity and additional capacity in SJGS Unit 4;

- Comply with the Regional Haze Rule as required by the FIP by installing SCR on all four units at SJGS (no replacement capacity is needed in this case); and
- Comply with the Regional Haze Rule by retiring all four units at SJGS and replacing the retired capacity with PVNGS Unit 3 and a combination of natural gas and renewable energy resources.

**Q. HOW DID PNM IDENTIFY THE MOST COST-EFFECTIVE REPLACEMENT POWER PORTFOLIOS?**

A. PNM used an integrated planning approach to determine the most cost-effective portfolios for each of the Regional Haze Rule compliance strategies. This involved assessing the costs and production impacts of installing SNCR or SCR at SJGS as well as evaluating potential replacement resources for unit retirements at SJGS. Resources were analyzed not just as stand-alone resources, but also considering their effect on overall system costs. In addition to PVNGS Unit 3, gas peaking, solar generation and additional capacity in SJGS Unit 4, PNM considered other types of natural gas capacity and wind resources while assuming continued growth of PNM's energy efficiency resources and distributed generation.

**Q. WHAT DOES YOUR ANALYSIS SHOW AS THE MOST COST-EFFECTIVE REGIONAL HAZE COMPLIANCE PORTFOLIO?**

A. The most cost-effective of the four portfolios is the first – meeting the Regional Haze Rule requirements through the Revised SIP and replacing the retired SJGS capacity with PVNGS Unit 3, solar generation, a gas peaking unit and additional capacity in SJGS Unit 4. This portfolio is the lowest in cost and provides the best protection against the risks of future cost increases due to volatile natural gas prices and anticipated environmental regulation.

**Q. PLEASE DESCRIBE PVNGS.**

A. PVNGS is located west of Phoenix, Arizona, and is the nation's largest nuclear generating station. The three units at PVNGS came on line between 1986 and 1988 and have operating licenses that extend through 2047. PNM owns 10.2% of each of the units at PVNGS, but only Unit 1 and Unit 2 have CCNs to serve PNM's NMPRC jurisdictional customers. As discussed by PNM witnesses Mr. Sategna, Mr. Ortiz and Mr. Horn, PVNGS Unit 3 is a resource that is currently "excluded" from PNM's jurisdictional generating resources.

**Q. WHAT COST DID YOU ASSUME FOR PALO VERDE UNIT 3 IN YOUR ANALYSIS?**

A. I assumed that PNM would add Palo Verde Unit 3 at a cost of $2,500/kW, or $335 million. This is the value at which PNM is willing to offer this resource for use as certificated plant to serve NMPRC jurisdictional customers, as explained in Mr. Darnell's testimony. I will show that PVNGS Unit 3 is the most cost effective SJGS

replacement option for PNM's customers at a cost significantly higher than the $2,500/kW proposed by PNM.

**Q. HOW DID PNM DETERMINE PORTFOLIO COSTS?**

**A.** For this analysis, PNM used the Strategist® modeling software. Strategist® is a comprehensive long-range resource planning tool for electric utilities. The Strategist® model utilizes a proprietary, dynamic programming algorithm to conduct a rigorous evaluation of up to 5,000 unique resource portfolios and selects and ranks the resource portfolios based on various user-specified criteria. Strategist® is capable of modeling a wide range of resource alternatives such as energy efficiency and demand side alternatives, storage technologies, renewable and thermal generating units, various types of power purchase and sales agreements and the electric market. Strategist® identifies the least-cost resource portfolio according to the net present value ("NPV") of total utility cost that meets user-designated constraints such as reserve margin, loss of load hours, emissions mandates, construction limitations and renewable portfolio standards.

Strategist® input data includes fuel price projections, new resource construction costs, demand and energy forecasts and shapes, energy efficiency projections, resource performance characteristics such as dispatchability, transmission capacity attributes, resource retirements, planned outages and others. Strategist® optimizes portfolio selection by calculating capital requirements, fuel costs and O&M costs using economic dispatch to meet demand and energy requirements for each of the thousands of portfolio options and ranking each by the net present value of total utility cost. Strategist®

considers both the existing resource portfolio and new resource options when determining the most cost effective portfolio for a given scenario.

The model output, as summarized in PNM Exhibit PJO-3, includes the NPV of the portfolio over the 20-year analysis period, study period loss of load probability, which is a measure of the portfolio's reliability, and the range of the risk that the cost of the portfolio over the 20-year period will be higher or lower due to fluctuations in electricity energy and demand requirements, natural gas prices and environmental regulations. Additionally, Strategist® provides a summary of resource type and capacity utilization of existing and new resource additions by year over the 20-year planning period.

**Q. WILL RESOURCES IN ADDITION TO PVNGS UNIT 3 AND ADDITIONAL CAPACITY IN SJGS UNIT 4 BE REQUIRED IF UNITS 2 AND 3 ARE RETIRED?**

A. Yes. Although our analysis to identify those resources is on-going as part of the IRP evaluation process, the analysis conducted to date indicates that in addition to PVNGS Unit 3 and additional capacity in SJGS Unit 4 the near-term resource additions that would most economically replace the generation capacity of the retired units at SJGS are solar photovoltaic generation and a gas-fired peaking facility. PNM has not made its final selection of these new resources and additional information important to resource selection will be obtained in future requests for proposals. Furthermore, the need for replacement resources for which PNM would request approval in the future depends fundamentally on whether the Commission approves PNM's requested abandonment of

SJGS Units 2 and 3 and CCNs for the inclusion of PVNGS Unit 3 as a jurisdictional resource and additional capacity in SJGS Unit 4. PNM will request Commission approval of the additional solar, gas-fired or other replacement resources in future proceedings.

**Q. PLEASE COMPARE THE COST OF EACH OF THE FOUR PORTFOLIOS DESCRIBED ABOVE.**

A. PNM Exhibit PJO-3 provides a detailed comparison of the four portfolios I have described above. In summary, the exhibit shows the net present value of revenue requirements ("NPVRR") for each of the four portfolios. NPVRR is calculated by discounting the annual revenue requirements for the cost of the new resource additions and the system operation and maintenance costs for each portfolio over the 20-year planning period using a discount rate equal to a weighted average cost of capital ("WACC") of 8.18%. The NPVRR methodology allows a comparison of the cost of each portfolio on a comparable basis over the entire 20-year planning period, since the revenue requirements of each portfolio will differ from year to year over the planning period. The NPVRR of each of the four comparison portfolios is as follows:

1) **Install SNCR on Units 1 and 4 and retire Units 2 and 3 consistent with the Revised SIP and include PV3 in the portfolio for replacement capacity (Revised SIP with PV Unit 3).** This is the least cost portfolio over the twenty year planning horizon. The net present value over twenty years of the revenue requirements associated with this portfolio is $780 million less than the portfolio in which SCR is installed on all four SJGS units and the capacity in SJGS Units 2 and

3 is retained. PNM Exhibit PJO-4 provides a Load and Resource Table illustration of this portfolio.

2) **Install SNCR on Units 1 and 4 and retire Units 2 and 3 consistent with the Revised SIP and replace the capacity with gas-fired generation instead of PV Unit 3 (Revised SIP with gas instead of PV Unit 3).** The net present value over twenty years of the revenue requirements associated with this portfolio is $56.8 million more than the NPVRR of Revised SIP with Palo Verde Unit 3 portfolio. The higher cost is due to the need to rely more heavily on gas-fired generation when PVNGS Unit 3 is not included in the portfolio.

3) **Install SCR on all four generation units at SJGS consistent with the FIP.** This portfolio is the most expensive of the options and, as noted above, is $780 million more expensive than the Revised SIP with Palo Verde Unit 3 portfolio. The higher cost reflects the very near-term upfront capital cost of installing SCR at SJGS and the ongoing cost of fuel and operation and maintenance expense for the SJGS capacity that, under the Revised SIP portfolios, would be retired.

4) **Retire all four units at SJGS.** This portfolio is $558 million more expensive over twenty years than the Revised SIP with PV Unit 3 portfolio. In addition to replacing the retired SJGS capacity with Palo Verde Unit 3 and renewables, this portfolio requires the inclusion of a significantly greater amount of new natural gas generation than the Revised SIP portfolio and, as I address below, is the riskiest of the four portfolios due to volatile natural gas prices and a range of future costs associated with anticipated environmental regulation.

**Q. PLEASE COMPARE THE "RISKINESS" OF THE FOUR PORTFOLIOS IN TERMS OF SENSITIVITY TO DEMAND AND ENERGY VARIATIONS, NATURAL GAS PRICE INCREASES AND THE COST OF ANTICIPATED ENVIRONMENTAL REGULATION.**

A. It is important to quantify the potential risk of cost increases associated with each portfolio because it is impossible to know the future with certainty, so prudent planning involves choosing a course of action that leads to acceptable results under a wide range of circumstances. Table PJO-2 shows the cost risk measure for each of the four portfolios. The cost risk measure is a statistical measure of the range of potential cost variation over twenty years. When comparing portfolios, a higher cost risk measure means that the portfolio is more susceptible to future cost increases due to natural gas price volatility, anticipated environmental regulations, variations in system demand and energy requirements and other variables.

**Table PJO-2**
**Portfolio Cost Summary**

| **Portfolio** | **Risk Measure** ($ M) |
|---|---|
| 1) Revised SIP with PV Unit 3 | $ 194 |
| 2) Revised SIP without PV Unit 3 | $ 247 |
| 3) FIP | $ 225 |
| 4) Retire SJGS | $ 349 |

Note that the Revised SIP portfolio that includes Palo Verde Unit 3 is the least risky. The portfolio that includes the complete retirement of all SJGS units is the most risky, with the risk measure that is 80% higher than the risk measure for the Revised SIP portfolio with Palo Verde Unit 3.

**Q. WHAT DRIVES THE MAGNITUDE OF THE RISK MEASURE?**

**A.** Three variables have the most impact on the risk measurement calculation: the demand and energy forecast, natural gas prices and estimates of a future cost associated with carbon dioxide emissions. The magnitude of the risk measure is primarily driven by the estimated amounts of natural gas burned and carbon dioxide emitted over twenty years by each of the portfolios in the comparison. In addition, variations in the demand and energy forecast have a more pronounced effect on the volatility of the total costs in portfolios with the greatest exposure to natural gas and carbon dioxide emission price changes. The Revised SIP portfolio that includes Palo Verde Unit 3 is the least risky because there are no carbon dioxide emissions from Palo Verde Unit 3 and its inclusion in the portfolio reduces the need to rely on carbon-emitting natural gas generation.

**Q. WHY DID YOU INCLUDE FUTURE COSTS OF CARBON DIOXIDE EMISSIONS TO CALCULATE THE PORTFOLIO COST ESTIMATES?**

**A.** The IRP Rule requires utilities to assume a cost associated with carbon dioxide emissions for purposes of resource planning. In Case No. 06-00448-UT, the Commission adopted standardized prices for carbon emissions to use for these planning assumptions. The standard monetary values adopted in 2006 are now out of date,

because greenhouse gas regulation has not yet resulted in an additional cost associated with greenhouse gas emissions at electric generation stations, but the process that will result in greenhouse gas emission regulations at new and existing electric generation stations is underway. It is simply not reasonable to assume that there will not be additional costs associated with greenhouse gas emissions during the twenty-year planning period. As I describe later in my testimony, PNM has addressed the need to include future greenhouse gas emission costs in resource planning by hiring PACE Global to provide a projection of such costs based on current policy assumptions and a nationwide model of electricity generation.

**Q. HOW DID PNM CALCULATE THE RISK MEASURE?**

**A.** PNM calculated the risk measure using an analytic technique called Monte Carlo simulation. Monte Carlo simulation uses randomly selected values from probability distributions as risk variables to determine how a change in estimated values of the variables affects the total cost estimate. Performing the Monte Carlo simulation consists of the following steps:

- Step 1: Determine the potential range of values for input variables (including load forecast, natural gas fuel prices, market prices for electricity, and $CO_2$ costs). Then define a probability distribution for each variable, i.e. the likelihood that each value in the range may occur.
- Step 2: Determine the correlation among input variables if any, i.e. the change in one variable directly related to a change in another variable.

- Step 3: Generate 900 sets of random input conditions, one value from each probability distribution while reflecting any correlation among the variables, for each year of the study period. Each set is referred to as a "draw."
- Step 4: Calculate the resource portfolio's total system cost for each of the 900 draws using Strategist® to optimize portfolio dispatch.
- Step 5: Aggregate the results of the random draws from Step 4 and calculate the average cost and cost variability.

Using the result of step three, steps four and five were applied to each portfolio, using the same randomly generated conditions. For my testimony, the average cost calculated through this process is used to report the net present value of revenue requirements over twenty years and the cost variability, a calculated statistic called the 95th percentile risk, is reported as the risk measure.

**Q. WHAT DOES THE 95TH PERCENTILE RISK REPRESENT?**

A. The 95th percentile risk measure reflects a five percent likelihood that a given portfolio's actual costs will be greater than the risk value. For instance, the Revised SIP with PV Unit 3 portfolio risk measure is $194 million dollars. This measure reflects a five percent likelihood that portfolio actual costs will be greater than $6,834 million dollars ($6,640 million plus $194 million) over the next 20 years and a 95% likelihood that portfolio costs will be less than $6,834 million dollars over the next 20 years. So a larger 95th percentile risk value means a portfolio's NPVRR is more likely to exceed the average NPVRR than would be the case with a lower 95th percentile risk value.

**Q. WHAT ASSUMPTIONS REGARDING RESOURCE AVAILABILITIES AND COSTS DID PNM MAKE TO PRODUCE THE PORTFOLIO COMPARISONS?**

A. The resource availability and cost assumptions PNM used in this analysis are provided in PNM Exhibit PJO-5. These assumptions are the same assumptions PNM is using to develop the 2014-2033 IRP. The data was gathered from the best sources available to PNM. For example, costs for renewable generation are based on the bids PNM received in response to the request for proposals issued in late 2012 to develop PNM's 2014 Renewable Procurement Plan. Natural gas generation costs are based on an Electric Power Research Institute ("EPRI") Technical Assessment Guide ("EPRI TAG") cost database that is reviewed and updated annually for the electric industry. An important set of assumptions for the analysis includes future natural gas and carbon dioxide prices. PNM hired PACE Global to develop these prices using their models of the national, interconnected natural gas and electric systems. I have included the documentation of PACE's work in PNM Exhibit PJO-5.

**Q. WHY DID YOU USE A TWENTY-YEAR PERIOD TO CALCULATE THE PORTFOLIO COST ESTIMATES?**

A. The IRP Rule, at Section 7(J), defines the planning period to be used as a twenty-year period. New Mexico and the Commission require the development of a long term resource plan through an IRP process. Also, resource planning requires a long-term view to ensure the development of the most cost-effective portfolio.

**Q. PLEASE ELABORATE ON YOUR EARLIER STATEMENT THAT THE INCLUSION OF PALO VERDE UNIT 3 RESULTS IN A COST EFFECTIVE PORTFOLIO EVEN AT A PRICE SIGNIFICANTLY HIGHER THAN THE $2,500/KW PROPOSED BY PNM.**

A. PNM conducted a sensitivity analysis around the price of Palo Verde Unit 3 and found that the most cost effective Revised SIP portfolio includes Palo Verde Unit 3 up to a price of $3,100/kW or $415.4 million. PNM has proposed including Palo Verde Unit 3 in rate base at a price of $2,500/kW or $335 million. To conduct the sensitivity analysis, PNM included Palo Verde Unit 3 as a resource option in the Strategist modeling at a range of prices. Only when the price for Palo Verde Unit 3 exceeds $3,100/kW, does gas-fired capacity becomes a less expensive replacement for SJGS capacity than Palo Verde Unit 3. So, while PNM has determined that $335 million is a fair price for including Palo Verde Unit 3 in PNM's rate base, the value of Palo Verde Unit 3 to PNM's customers exceeds this cost by $80.4 million.

**Q. HOW WILL THE PROPOSED RETIREMENT OF SJGS UNITS 2 AND 3 AND THE OWNERSHIP EXCHANGE OF 78 MW FROM UNIT 3 TO UNIT 4 AFFECT THE AMOUNT OF CAPACITY THAT PNM OWNS AT SJGS?**

A. Table PJO-3 provides the capacity currently held by PNM in each of the SJGS units and the capacity that would be held, assuming Commission approval of PNM's requests in this case, after the retirement of SJGS Units 2 and 3 and PNM's acquisition of an additional 78 MW in Unit 4. The ownership transfer of 78 MW from Unit 3 to Unit 4 is described by Mr. Olson.

**Table PJO-3**

| | Current MWs | Change | Result |
|---|---|---|---|
| Unit 1 | 170 | 0 | 170 |
| Unit 2 | 170 | -170 | 0 |
| Unit 3 | 248 | -248 | 0 |
| Unit 4 | 195 | +78 | 273 |
| Total | 783 | -340 | 443 |

**Q. DOES THE MOST COST-EFFECTIVE RESOURCE PORTFOLIO INCLUDE THE 78 MW OWNERSHIP TRANSFER FROM SJGS UNIT 3 TO UNIT 4?**

A. Yes. This ownership transfer results in a more cost effective portfolio than would result from a net retirement of more than 340 MW at SJGS. If the ownership transfer did not occur and PNM's net retirement at SJGS were 418 MW, the most cost effective portfolio would still be the Revised SIP portfolio with Palo Verde Unit 3, but the net present value would increase by $79 million due to increased reliance on natural gas generation, as referenced in PNM Exhibit PJO-6. The risk measure would also increase by $11 million.

**Q. DID PNM ASSUME THAT A NATURAL GAS PEAKING PLANT IN THE SJGS REPLACEMENT PORTFOLIOS WOULD BE SITED AT SJGS?**

A. Yes. All of the SJGS replacement portfolios include at least one heavy-frame gas peaking plant as part of the most cost effective mix of replacement capacity. PNM

assumed that the first such gas peaking plant in each portfolio would be sited at SJGS due to the permitting and economic advantages of using that site. PNM currently owns sufficient land at the station to build and operate a natural gas peaking facility. Locating the peaking facility at SJGS will significantly reduce the need to build transmission interconnection facilities for the new gas plant because the gas plant will be able to use existing transmission facilities that are currently serving SJGS Units 2 and 3. Siting new generation at an existing generation facility also simplifies permitting the new facility since there is no change in land use associated with the new construction. An estimate of $10 million to pay for construction of a new gas supply line from existing, nearby gas transmission lines to SJGS is included in the plant construction costs for the gas facility.

## IV. RELATIONSHIP TO 2014-2033 IRP

**Q. HOW IS PNM COORDINATING THIS FILING WITH PNM'S 2014-2033 IRP?**

**A.** PNM's 2014 IRP is scheduled to be filed with the Commission by July 2014. Consistent with the IRP Rule, the IRP will present an analysis of portfolio alternatives over the next twenty-year period, identify the most cost-effective portfolio, and include a four-year Action Plan. I anticipate that the key near-term elements of that Action Plan will include:

- Pursue abandonment of SJGS Units 2 and 3 by the end of 2017;
- Pursue approval for a CCN for 78 MW of capacity in SJGS Unit 4 by January 1, 2015;

- Pursue approval for a CCN to include PVNGS Unit 3 as a jurisdictional generating resource;
- Identify new natural gas resources required to replace capacity being retired at SJGS and file a CCN to have such resources in place by early 2018; and
- Identify 40 MW of new solar resources to be constructed as replacement generating capacity for the retired SJGS capacity and seek NMPRC approval to construct and operate such facilities by 2016.

Consistent with the IRP Rule, PNM began the IRP Public Advisory Process in July 2013. A number of meetings with the public and the Public Advisory Group have been conducted. The analysis presented in my testimony has been discussed in the public advisory process. PNM anticipates that during the next few months, through the IRP process, the remaining resources necessary for replacement of the retired generation capacity in SJGS Units 2 and 3 will be specifically identified and addressed in the four year Action Plan, and an over-all, long-term resource plan for meeting forecasted customer loads over the next twenty years will be described. Of course, this longer-term plan will again be revisited by PNM in its next (2017) IRP process.

**Q. FROM AN IRP PERSPECTIVE, WHY SHOULD THE NMPRC APPROVE PNM'S REQUEST FOR A CCN TO TRANSFER 78 MW OF CAPACITY FROM SJGS UNIT 3 TO SJGS UNIT 4?**

**A.** All portfolios that include the additional capacity in SJGS Unit 4 are lower in cost and less risky than portfolios that do not. Including an additional 78 MW of capacity in Unit

4 is cost-effective. It is an existing resource and is not subject to siting and construction uncertainties as may exist for new resources.

**Q. FROM AN IRP PERSPECTIVE, WHY SHOULD THE NMPRC APPROVE PNM'S REQUEST FOR A CCN TO INCLUDE PVNGS UNIT 3 AS A JURISDICTIONAL RESOURCE?**

A. Next to the addition of 78 MW of SJGS Unit 4 capacity in the resource portfolio, PVNGS Unit 3 is the most cost-effective resource option for replacement of the abandoned base-load capacity in SJGS Units 2 and 3. All portfolios that include PVNGS Unit 3 are lower in cost and less risky than portfolios that do not. All such portfolios showed lower levels of $CO_2$ emissions and cost risks than portfolios that did not include PVNGS Unit 3. It is an existing resource and PNM controls sufficient transmission capacity to bring the generation to the Four Corners area and into PNM's load centers. Granting PNM's application for a CCN for PVNGS Unit 3 reduces the amount of new generation capacity that PNM must obtain and results in significant savings to customers over the twenty-year planning period.

## V. CONCLUSIONS

**Q. DO YOU HAVE ANY CONCLUDING OBSERVATIONS?**

A. Yes. Complying with the requirements of the Regional Haze Rule by retiring Units 2 and 3 at SJGS and, installing SNCR on Units 1 and 4, pursuant to the Revised SIP, and replacing the retired capacity with Palo Verde Unit 3, 40 MW of solar generation, a natural gas peaking facility located at SJGS and an additional 78 MW of capacity in SJGS Unit 4 is in PNM's customers' best interests because it is the most cost-effective

approach available to PNM and provides significant environmental benefits. Accordingly, the NMPRC should approve PNM's Application in this case.

**Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?**

**A.** Yes.

*GCG# 517366*