EFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF PUBLIC SERVICE COMPANY OF NEW MEXICO'S ABANDONMENT OF SAN JUAN GENERATING STATION UNITS 1 AND 4	))))	Case No. 19-00018-UT

REBUTTAL TESTIMONY

OF

NICHOLAS PHILLIPS

November 15, 2019

NMPRC CASE NO. 19-00018-UT
INDEX TO THE REBUTTAL TESTIMONY OF
NICHOLAS PHILLIPS

WITNESS FOR
PUBLIC SERVICE COMPANY OF NEW MEXICO

REBUTTAL TESTIMONY
OF NICHOLAS PHILLIPS
NMPRC CASE NO. 19-00018-UT

I. INTRODUCTION AND PURPOSE

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

A. My name is Nicholas Phillips. I am the Director of Integrated Resource Planning for Public Service Company of New Mexico ("PNM"). My address is 414 Silver Avenue, SW, Albuquerque, New Mexico 87102.

Q. HAVE YOU PREVIOUSLY FILED TESTIMONY IN THIS CASE?

A. Yes, I submitted direct testimony on July 1, 2019, and direct errata testimony on September 20, 2019.

Q. WHAT DOES YOUR REBUTTAL TESTIMONY COVER?

A. My rebuttal testimony responds to testimony offered by Utility Division Staff ("Staff") recommending the denial of PNM's Consolidated Application to abandon the San Juan coal plant because PNM did not specifically model one additional scenario that examined retrofitting the plant with Carbon Capture Utilization and Sequestration ("CCUS") technology. I also respond to intervenor testimony requesting that the New Mexico Public Regulation Commission ("NMPRC" or "Commission") include an evaluation of environmental benefits in the form of a Social Cost of Carbon as a part of its consideration of retiring the San Juan coal plant and in future resource planning dockets such as PNM's triennial Integrated Resource Plan filings.

Q. PLEASE SUMMARIZE YOUR CONCLUSIONS.

A. Staff Witness Solomon is the only party that filed testimony in this proceeding recommending that PNM's application for abandonment be denied. In reaching this conclusion, Staff Witness Solomon relied upon a pre-feasibility report prepared by a third party, without further independent evaluation or analytical support for his position.[1] Additionally, it appears that Staff Witness Solomon may have inadvertently misinterpreted certain portions of PNM's testimony as there are a few claims made by Staff Witness Solomon which seem out of place. Once these misinterpretations are rectified, the conclusions support the approval of PNM's request for abandonment for the reasons presented in my direct testimony. By abandoning its share of the San Juan coal plant in June 2022 and replacing it with PNM's proposed replacement portfolio, Scenario 1, PNM's customers can expect economic and environmental benefits over the next 20 years.

Incorporating a Social Cost of Carbon in this case (and future Commission proceedings) is a departure from existing Commission standards and is not needed to advance carbon-free energy in New Mexico. The Energy Transition Act has positioned New Mexico and PNM to be leaders in carbon-free energy by setting one of the most aggressive timelines in the nation to achieve a carbon-free energy supply by 2045. PNM has taken this policy a step further by self-imposing a goal of carbon-free generation by 2040. Had the Legislature intended for additional

[1] Staff Exhibit DS1

global externalities be considered by the NMPRC in abandonment or replacement resource decisions, a Social Cost of Carbon requirement would have been mandated in the Energy Transition Act.

II. RESPONSE TO STAFF

Q. PLEASE SUMMARIZE STAFF WITNESS SOLOMON'S CONCLUSIONS AND RECOMMENDATIONS WITH RESPECT TO ABANDONMENT OF THE SAN JUAN COAL PLANT.

A. Staff Witness Solomon recommends that PNM's application to abandon the San Juan coal plant be denied.[2] Staff Witness Solomon asserts that PNM's application does not meet the net public benefit test that has historically been used to analyze plant abandonment because PNM did not consider "all feasible scenarios" such as retrofitting the San Juan coal plant with CCUS technology.[3] Staff Witness Solomon reasons that because PNM focus is on transitioning towards clean energy, PNM did not evaluate all probable scenarios. Staff Witness Solomon also argues that by substituting one fossil fuel (coal) generation resource for another (natural gas) as proposed in Scenario 1, that any environmental benefits are negated because some of the replacement resources emit CO_2.[4] This idea has extended to a scenario that includes both a CCUS retrofit by Enchant Energy contemporaneous with a replacement portfolio by PNM

[2] Direct Testimony of Staff Witness Solomon at Page 19, Lines 12-13
[3] *Id.* at Lines 18-19
[4] *Id.* Page 19 Line 20 – Page 20 Line 4

Q. DO YOU AGREE WITH STAFF WITNESS SOLOMON'S ASSERTIONS?

A. No. It appears that in forming his recommendations, Staff Witness Solomon misinterpreted PNM's testimony and PNM's resource planning process. I address these items in this section of my rebuttal testimony and demonstrate that once each of these issues are addressed, the conclusion that abandoning the San Juan coal plant remains in the best interest of PNM's customers.

Q. IS PNM PROPOSING TO RETIRE THE COAL PLANT FOR THE SOLE PURPOSE OF PROMOTING RENEWABLE ENERGY DEVELOPMENT IN THE STATE, AS SUGGESTED BY STAFF WITNESS SOLOMON?

A. No. In order to reach this conclusion, Staff Witness Solomon focuses on my Direct Testimony from Page 5 Line 20, to Page 6 Line 2 without acknowledging the first sentence in that same paragraph which began on line 17 of Page 5. The full paragraph reads:

> **The new analyses performed in preparation for filing the Consolidated Application demonstrate, consistent with the conclusions reached in the 2017 IRP and updated analyses, that the early retirement of Units 1 and 4 will result in long-term cost savings for PNM' s retail customers and net public benefits.** Retiring the San Juan coal plant will also provide the opportunity for PNM to replace the plant with resources that better match varying loads and are better suited to accommodate the anticipated deployment of more renewable energy in New Mexico and the regional market. (emphasis added to the section omitted from Staff Witness Solomon's testimony)

PNM's proposal to abandon the San Juan coal plant is predicated upon a net public benefit resulting from this action. Staff Witness Solomon omits from consideration the significant analyses of the economics associated with

abandonment of the San Juan coal plant. Beginning with the 2017 IRP, continuing with several updates to the analyses, up through and including the filing of PNM's application in this case, the results consistently demonstrate that the abandonment of the San Juan coal plant will benefit PNM's customers. Much of the reason for this result is the decreasing cost for renewable energy and energy storage options, as well as the availability of grey market aeroderivative gas turbines, which results in a replacement portfolio that is less costly , environmentally sustainable and more flexible.

Q. WHAT INFORMATION SUPPORTS THE NET PUBLIC BENEFIT TO ABANDONING THE SAN JUAN COAL PLANT?

A. A full description of the abandonment analysis is presented in Section III of my direct testimony. To summarize, the future plant economics have been periodically evaluated by PNM. One of the primary findings in PNM's 2017 IRP was that PNM's customers would benefit from PNM retiring the San Juan coal plant at the end of the current fuel supply and plant operating agreements. Between then and the time this case was filed in July of 2019, additional analyses were performed and the Energy Transition Act was passed. Upon passage of the Energy Transition Act, PNM expanded its modeling framework to take account of the newly applicable law in its modeling (securitization, economic mitigation measures for impacted workers and communities, enhanced renewable portfolio standards and carbon emission limits). At each step in the analyses, the results were consistent – PNM's customers would economically benefit if PNM

abandoned the San Juan coal plant in 2022. The savings to customers, which have been estimated conservatively, are nearly $400 million Net Present Value ("NPV") compared to the continued operations of the coal plant.

Q. WHY DOES STAFF WITNESS SOLOMON TAKE ISSUE WITH PNM'S ABANDONMENT ANALYSIS?

A. Staff Witness Solomon faults PNM for not using as its baseline an alternative scenario that considered that the San Juan coal plant would begin operating in 2023 as a retrofitted plant with CCUS technology. Staff Witness Solomon cites to a pre-feasibility study performed on behalf of Enchant Energy and finalized on July 8, 2019 ("2019 CCUS Study"), after PNM filed its application in these proceedings, suggesting the economics of a CCUS retrofit have changed since being analyzed by PNM.[5] Along with revised capital and operating cost assumptions, Staff Witness Solomon claims that the availability of IRS "Section 45Q" tax credits and potential Enhanced Oil Recovery ("EOR") revenues create more beneficial conditions for a CCUS retrofit that PNM should have evaluated before filing its application.[6] Staff Witness Solomon concludes that because PNM did not consider this additional alternative, PNM has not met its burden to demonstrate that there is a net public benefit from abandoning the coal plant.[7]

[5] Direct Testimony of Staff Witness Solomon at Page 13 Lines 10-12
[6] *Id.* at Page 15 Lines 4-21
[7] *Id.* at Page 16 Lines 15-20

Q. IS STAFF WITNESS SOLOMON CORRECT WHEN HE CITES THE 2019 CCUS STUDY AS A REASON TO RE-EVALUATE THE CCUS TECHNOLOGY FOR THE SAN JUAN COAL PLANT?

A. No. In 2010, PNM commissioned Sargent & Lundy ("S&L") to perform a study evaluating CCUS at San Juan under a 4-unit configuration ("2010 CCUS Study"). Based on the results of that study, PNM determined the CCUS retrofit option for San Juan to be both highly risky and cost-prohibitive. Staff Witness Solomon acknowledges this study; however, he asserts that PNM did not conduct any follow- up studies to further investigate this technology.

It is common knowledge in the utility industry that CCUS technology is still in the development stage when it comes to retrofitting large coal-fired resources, and only two relatively small scale CCUS retrofitted coal plants exist in North America. It is not considered an established, commercialized technology (especially for large coal fired generating plants), and hence, creates uncertainty in terms of cost and performance. By its own terms, the 2019 CCUS Study is only a preliminary study and is not intended as a demonstration of the viability of retrofitting the San Juan Coal Plant with CCUS. As a result the 2019 CCUS Study recommends in depth engineering and financial studies to inform any business decision that gives consideration to a CCUS retrofit at the San Juan coal plant.[8]

[8] Staff Exhibit DS1 at Page ES-2 states, "As part of the next steps of this project, it is recommended that a more in-depth front-end engineering and design (FEED) study be conducted to advance the project definition, engage the technology providers to provide site-specific performance data, and develop a detailed cost estimate. … If the FEED study demonstrates the viability of the project…"

Additionally, as I discuss further, the cost estimates included in the 2019 CCUS Study are much lower than recent projects have been able to realize.

Q. WAS THERE ANY REASON TO CONSIDER CCUS IN EVALUATING ALTERNATIVE SCENARIOS TO ABANDONMENT?

A. As noted previously, PNM engaged Sargent & Lundy in 2010 to evaluate the retrofit of CCUS at the San Juan coal plant. The 2010 CCUS Study found "considerable risk due to the uncertainty in cost and performance" related to retrofitting SJGS with CCUS technology.[9] Given the risks identified in the study, the results from PNM's 2017 IRP, the results of the competitive RFP, and the decision of all but one (City of Farmington) of the plant's current owners to not continue operations beyond June 2022[10], there was no valid reason for further evaluating an alternative scenario that includes CCUS retrofitting of the San Juan coal plant.

Q. WHY IS PNM CONCERNED ABOUT THE FEASIBILITY AND OPERATIONAL RISKS OF A CCUS RETROFIT AT THE SAN JUAN COAL PLANT?

A. To date there are only two utility scale CCUS installations in operation in North America. Another attempt at utility scale CCUS was abandoned after incurring

---

Further on Page 6-1 the study concludes, "At this time, minimal engineering has been conducted for the design of the CO_2 capture system integration to develop an order of magnitude cost."

[9] See page ES-6 of Alternatives Study, San Juan Generating Station, PNM, Sargent & Lundy, published on February 25, 2010.

[10] See PNM Witness Fallgren discussion of the participants positions.

billions of dollars in cost overruns.[11] While CCUS has been included in other utility IRP studies over the last decade, this technology has yet to be embraced or generally adopted by the utility industry. Furthermore, the two CCUS installations currently operating were significantly more expensive on a $/kW basis than the estimated costs Staff Witness Solomon cites for retrofitting the San Juan coal plant.[12]

Q. HAS STAFF WITNESS SOLOMON PRESENTED AN INDEPENDENT ANALYSIS OF THE 2019 CCUS STUDY?

A. No. Nor does Staff conclude that retrofitting the San Juan coal plant with CCUS will be more economic than PNM's proposal.

Q. COULD STAFF HAVE REQUESTED THAT PNM MODEL THE CCUS ALTERNATIVE DISCUSSED IN ITS TESTIMONY?

A. Yes. In PNM's Modeling Proposal, PNM agreed to either perform modeling requests on behalf of Staff and intervenors or provide them the same software utilized by PNM in support of its filing so that parties could perform their own analysis. Staff selected "Option 1" which was to have PNM perform analysis at Staff's Request; however, Staff did not request any modeling runs to substantiate its position.

[11] See the Rebuttal Testimony of PNM Witness Graves and his discussion on the Kemper IGCC in Mississippi
[12] See the Rebuttal Testimony of PNM Witness Graves

Q. TO SATISFY STAFF'S CONCERN, HAS PNM MODELED A SAN JUAN COAL PLANT CCUS RETROFIT ALTERNATIVE?

A. Yes. In order to address Staff Witness Solomon's concern, PNM performed a San Juan coal plant CCUS retrofit analysis based on the 2019 CCUS Study presented as Staff Exhibit DS-1.

Q. WHAT ARE SOME OF THE ISSUES WITH MODELING CCUS AS ADVOCATED BY STAFF?

A. CCUS is a nascent technology with limited historic data to rely upon for comparison or estimation. As discussed in more detail in the Rebuttal Testimony of PNM Witness Graves, the capital cost figures presented in the 2019 CCUS Study are much lower on a $/kW basis compared to the two existing CCUS projects referenced by Staff Witness Solomon.[13] As mentioned earlier, the 2019 CCUS Study states that, "At this time, minimal engineering has been conducted for the design of the CO_2 capture system integration to develop an order of magnitude cost."[14] The study recommends further study to demonstrate viability and determine detailed cost estimates.[15] In addition to the capital cost for the CCUS installation, the 2019 CCUS Study made a number of other assumptions that likely understate the true costs of the CCUS retrofit alternative.

[13] PNM Table FG-2 (Rebuttal) shows that the Boundary Dam and Petra Nova CCUS projects cost $5,800/kW and $3,875kW compared to the S&L estimate for SJGS of $2,155/kW.
[14] Staff Exhibit DS1 at Page 6-1
[15] *Id.* at Page ES-2t

Q. PLEASE DESCRIBE THE MAJOR ASSUMPTIONS YOU USED TO MODEL THE SAN JUAN CCUS RETROFIT SCENARIO?

A. The starting point for the costs associated with the San Juan coal plant CCUS Scenario was the 2019 CCUS Study. For modeling this scenario PNM assumed it would maintain its existing share of the San Juan coal plant and the same proportional share of costs going forward.[16] Specific future plant ownership is unknown. This study provided the capital and O&M cost assumptions utilized in the analysis. Adjustments were made to reflect PNM's cost of capital, and to include estimated ongoing capital expenditures[17] that would be required, as well as decommissioning expense for the CCUS facility to remain consistent with how San Juan coal plant continued operations was modeled. A depreciable life of 17 years was used consistent with PNM's commitment to be carbon-free by 2040. PNM also utilized the parasitic load assumption contained in the 2019 CCUS Study.

PNM analyzed the CCUS retrofit assuming that PNM is only serving its retail load requirements and not making speculative off-system sales. This assumption is consistent with PNM's IRP planning practice to ensure that rate base resources are justified as a retail need. PNM did allow for a redispatch of the system to recognize the revenues available from the 45Q tax credits as well as the EOR revenues; however, PNM disagrees with the assumption that the San Juan coal

[16] Exceptions made for proportional shares of costs subject to contractual arrangements that will change over time such as decommissioning costs.
[17] PNM conservatively assumed ongoing capital expenditures would equal 1% of the initial project cost per year.

plant would operate between 85%-100% capacity factor. A full list of the assumptions for the San Juan coal plant CCUS 1 case is presented as PNM Exhibit NLP-1 (Rebuttal).

Q. PLEASE LIST AND BRIEFLY DESCRIBE THE NUMBER OF ASSUMPTIONS, OTHER THAN THE CAPITAL COST, THAT OVERSTATE THE TRUE ECONOMICS OF THE CCUS RETROFIT ALTERNATIVE.

A. The following assumptions appear to overstate the true economics even with speculative CO_2 sales:

1. The ability to achieve an 85%-100% capacity factor. Historic data shows that on average over the last 10 years the San Juan coal plant capacity factor has been approximately 70%, ranging from 63%-80%.

2. That unit performance will be unaffected by the addition of the CCUS process and its high parasitic load.

3. That the heat rate of SJGS will be unaffected by the addition of the CCUS process.

4. That EOR revenues of $15-$20/tonne are realizable and sustainable over the life of the CCUS project.

5. That PNM will be able to contemporaneously monetize 100% of the 45Q tax credits. [18]

[18] For purposes of modeling, PNM did conservatively assume that the 45Q tax credits could be 100% monetized in all years.

In addition to the assumptions above, the study assumes sufficient capacity available on the Cortez CO_2 pipeline that would be required in order to realize any of the 45Q tax credits and EOR revenues. All of these assumptions make a CCUS retrofit a high cost, high risk endeavor.

Q. DID PNM EXAMINE DIFFERENT SETS OF ASSUMPTIONS FOR THE CCUS RETROFIT ALTERNATIVE?

A. Yes. When compared to the recent installed costs of the two existing CCUS installations, the assumptions presented in the 2019 CCUS Study are much lower. Along with analyzing what can be described as a "best case scenario" (utilizing a realistic capacity factor assumption), PNM also assessed the CCUS retrofit alternative under capital assumptions that are more in line with the Boundary Dam and Petra Nova facilities discussed by Staff Witness Solomon as well as alternative EOR revenues prices. The cases are referred to as SJGS CCUS 2 and 3 respectively. SJGS CCUS 2 is the same as SJGS CCUS 1 but utilizes a $12/tonne price for EOR (instead of $20/tonne), and SJGS CCUS 3 is the same as SJGS CCUS 2 but models a capital cost twice of that assumed in SGJS CCUS 1 and 2. This higher capital cost assumption falls between the Petra Nova and Boundary Dam costs on a $/kW basis. It is also worth noting that assuming any EOR revenues absent a long-term contractual arrangement goes against prudent planning practices as these revenues would be based on pure market speculation. PNM's planning practice ensures that resource alternatives are examined from a retail load perspective and not based on any merchant operations that would

expose retail customers to wholesale market risks. Absent a long-term EOR CO_2 sales contract to assure the EOR revenues, the EOR prices in the range of $15-20/tonne described in section 4.3 of 2019 CCUS Study as "CO_2 Market Opportunities" are speculative. In fact, every $1/tonne overstatement of EOR price places $21 million NPV of risk onto PNM's retail customers, assuming approximately a 70% capacity factor.

Q. DID PNM MODEL THE CCUS ALTERNATIVES USING THE SAME METHODS AS THE SAN JUAN CONTINUES SCENARIO?

A. The modeling analysis was performed using the same EnCompass software discussed in my direct testimony.

Q. WHAT ARE THE RESULTS OF YOUR ANALYSIS?

A. It is important to remember that the ultimate comparison is not whether CCUS provides economic benefit compared to the San Juan continues case presented in my Direct Testimony. Rather, the CCUS retrofit would need to achieve at least the same amount of expected benefits as Scenario 1, which has less risk. The results of PNM's analysis show that retrofitting the San Juan coal plant with CCUS is not in the best interest of PNM's customers on economic considerations alone. This is shown in PNM Table NLP-1 (Rebuttal) below. To recap the three CCUS retrofit cases:

- SJGS CCUS 1 uses the assumptions based on the S&L 2019 study as summarized in PNM Exhibit NLP-1 (Rebuttal)

- SJGS CCUS 2 is the same as SJGS CCUS 1 except uses a $12/tonne EOR price
- SJGS CCUS 3 is the same as SJGS CCUS 2 with the capital cost assumption doubled.

PNM Table NLP-1 (Rebuttal)

	SJGS CCUS Retrofit Comparison to Scenario 1			
	Scenario 1	SJGS CCUS 1	SJGS CCUS 2 w/$12 EOR	SJGS CCUS 3 w/double capital cost
NPV ($2019 M)	$5,916	$6,259	$6,423	$7,250
Delta NPV	----	$343	$507	$1,334

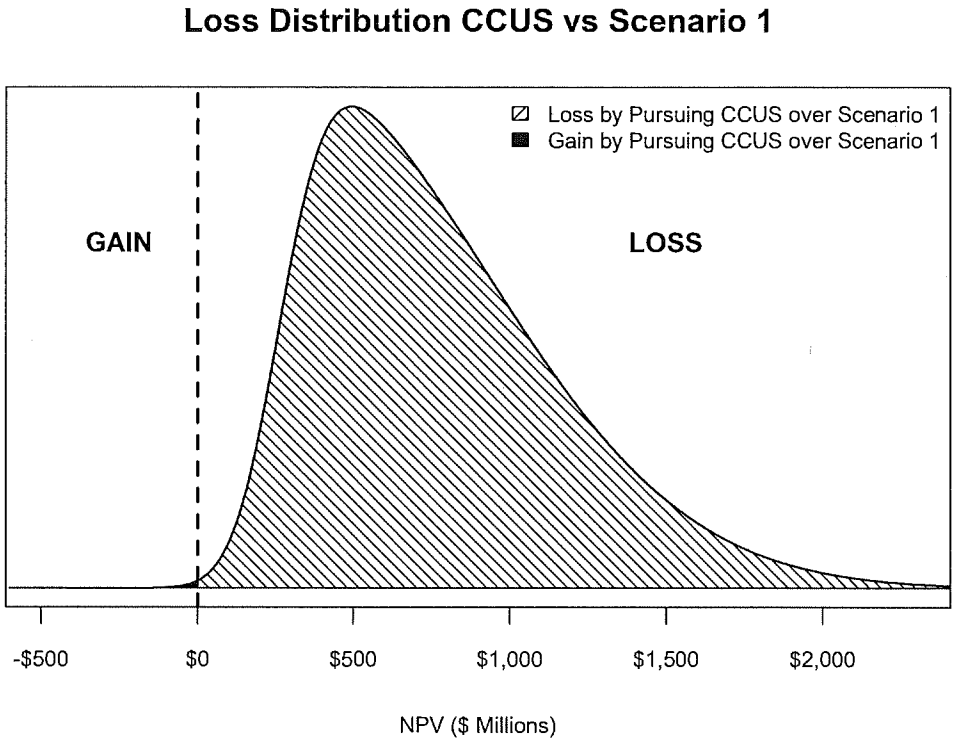
Furthermore, this analysis is conservative as it is possible that additional environmental expenditures would need to be made to add SCR to the plant in order to comply with the second planning period of US Environmental Protection Agency's Regional Haze Rule as discussed by PNM Witness Fallgren.

Q. HAVE YOU ALSO EXAMINED THE RISK PROFILE OF THE CCUS ALTERNATIVE?

A. Yes. PNM Figure NLP-1 (Rebuttal) below shows the loss distribution based on the table above. The horizontal axis shows in millions of dollars how much incremental cost customers would pay if the San Juan coal plant were retrofitted with CCUS rather than abandoning the plant and pursuing Scenario 1. This shows that there is very high probability that PNM's customers will pay

potentially billions of dollars more if the San Juan coal plant is retrofitted with CCUS.

PNM Figure NLP-1 (Rebuttal)



As I discussed earlier, every $1/tonne assumed for EOR prices is equivalent to almost $21 million NPV which presents a large risk to customers if that price does not materialize. Similarly, assumed capital cost for the CCUS retrofit presents a risk of about $40 million NPV for each $100/kW increase in capital costs. Using this information, the risk profile can be extrapolated using an EOR price range of

$0/tonnes to $40/tonnes,[19] a capital cost range of $2,155/kW from the 2019 CCUS Study to $5,800/kW based on the actual capital costs of the CCUS retrofits at Boundary Dam and Petra Nova. This range of sensitivities reinforces the figure above resulting in 120 of 123 cases where Scenario 1 outperforms the CCUS retrofit alternative, by over $1 billion on average and as much as $2 billion under certain assumptions.

Q. DOES THE PETRA NOVA PROJECT PROVIDE A VALID BENCHMARK FOR PURPOSES OF DETERMINING WHETHER PNM SHOULD PURSUE A CCUS RETROFIT FOR THE SAN JUAN COAL PLANT?

A. No. Staff Witness Solomon cites the Petra Nova installation as an example of a successful project.[20] However, there are some distinct differences and additional facts that must be acknowledged when comparing Petra Nova to the CCUS retrofit alternative for the San Juan coal plant. First, as shown in PNM Table FG-2 (Rebuttal), the Petra Nova CCUS project cost $3,875/kW compared to the 2019 CCUS Study estimate for the San Juan coal plant of $2,155/kW. In addition, Petra Nova required a new gas-fired cogeneration facility to be constructed to supply the steam and energy requirements for the CCUS process.[21] Petra Nova

[19] Direct Testimony of Staff Witness Solomon at FN 9, noting that the study presented a time series of EOR prices of $26 in 2020 increasing to $40 in 2050 (which represents approximately a $30/tonne price over the planning period) whereas for this extrapolation the price range of $0-$40 would be applied uniformly.
[20] Direct Testimony of Staff Witness Solomon at Page 13 Lines 15-21
[21] As discussed by PNM Witness Graves, the configuration of the San Juan CCUS retrofit is more similar to the Boundary Dam configuration compared to the Petra Nova and the Boundary Dam CCUS project cost $5,800/kW compared to the S&L estimate for SJGS of $2,155/kW.

also sits in the middle of ERCOT which provides a much greater depth of market for energy sales than is available to the San Juan coal plant. In addition and significantly, PNM is a regulated utility acting on behalf of its retail customers, not a merchant operator as is the case for Petra Nova (and potentially Enchant Energy). Consequently, PNM's ability to utilize CCUS and the risks associated with it are not the same as the case for Enchant Energy and for the Petra Nova facility. Merchant entities and regulated utilities operate for different reasons, have different cost structures and are subject to different risk profiles, laws and regulations. Therefore, it is inappropriate to utilize the same assumptions when comparing merchant operations such as those for Enchant to those for a regulated public utility like PNM.

Q. IS STAFF CORRECT THAT MORE CARBON EMISSIONS WILL RESULT IF THE SAN JUAN COAL PLANT CONTINUES AND PNM IMPLEMENTS ITS PREFERRED SCENARIO 1?

A. No. Staff incorrectly asserts that if the San Juan coal plant retrofitted with CCUS by Enchant and PNM's proposed replacement portfolio is constructed, the result would be more carbon emissions than exist today.[22] This is simply not true and moreover, Staff does not present any quantitative analysis to justify this assertion. In 2018, PNM's owned share of generation produced 6,143,409 annual tons of CO_2. Under Scenario 1, PNM expects its owned share of generation to produce 2,931,040 annual tons of CO_2. Thus, PNM's replacement portfolio would

[22] Direct Testimony of Staff Witness Solomon at Page 19 Lines 5-20

decrease CO_2 emissions by 3,212,369 annual tons (or about 50%) compared to 2018 emissions. Using the maximum operating assumptions in the 2019 CCUS Study of an unrealistic 100% capacity factor, total plant capacity of 847 MW, and a 90% CO_2 capture rate, the CO_2 emissions would drop by 40% below the 2018 level. Considering the emissions for PNM's Scenario 1 with an assumed additional CCUS operation, emissions would still be above the current San Juan operations.

Staff also claims that PNM is simply substituting one fossil fuel for another, which could lead to an increase in fossil fuel fired generation in the state and increase CO_2 emissions.[23] Under PNM's proposal, 497 MW of coal fired generation that historically has operated at a 70% capacity factor (equivalent to approximately 3 million MWh per year) would be replaced by 350 MW of solar resources, 130 MW of battery storage, and 280 MW of natural gas aeroderivative turbines. The aeroderivative turbines are expected to be flexibly dispatched and operate at less than a 10% capacity factor. Plus, natural gas contains less than half the carbon content compared to coal, and no emissions of SO_2 or particulate matter. This is why the proposed portfolio is expected to decrease CO_2 emissions by more than 50% compared to 2018 levels as I just discussed. PNM Table NLP-2 (Rebuttal) below shows a comparison of the San Juan coal plant to the proposed Scenario 1 replacement capacity and energy demonstrating the difference in

[23] *Id.*

expected carbon emissions. PNM's proposal is not "more of the same" but is a significant step to a clean energy future for New Mexico.

PNM Table NLP-2 (Rebuttal)

San Juan Continues				
Resource	Capacity (MW)	Firm Capacity (MW)	Annual Energy (MWh)	Annual CO_2 (tons)
SJGS 1& 4	497	497	3,047,604	3,324,936
Scenario 1				
Resource	Capacity (MW)	Firm Capacity (MW)	Annual Energy (MWh)	Annual CO_2 (tons)
Solar	450	40.5	1,300,860	0
Battery	130	130	0	0
Pinon	280	269	245,280	148,026
Replacement Energy*	0	0	1,501,464	620,105
Total	860	440	3,047,604	768,131

*Replacement Energy Assumes CO_2 Output of a Combined Cycle

Q. WHAT OTHER MISUNDERSTANDINGS PROFFERED BY STAFF WITNESS SOLOMON NEED TO BE ADDRESSED?

A. Staff Witness Solomon asserts that PNM ignores the principles of its own IRP planning process and instead selected generation resources with the express objective of promoting renewable development in the state.[24] The analysis performed in the 2017 IRP as well as all subsequent analyses have been prepared and analyzed balancing cost, reliability and the environmental impact using the same planning methodology PNM has always used. The assertion that PNM

[24] Direct Testimony of Staff Witness Solomon at Page 12 Lines 1-5)

selected resources as part of the replacement mix to promote renewables is incorrect. It is a number of collective conditions that are occurring today that provide the economics of the proposed replacement mix including: statutory portfolio requirements, the recent low cost of renewables, the current low cost of gas fired technology, the declining costs for battery storage, and the decline in natural gas prices. All these contribute to make a less expensive and more flexible replacement portfolio in Scenario 1 that better match varying loads compared to continuation of the San Juan coal plant base-load.

Q. PLEASE SUMMARIZE YOUR RESPONSE TO STAFF.

A. Staff Witness Solomon's recommendations are predicated upon a pre-feasibility report that is not suitable for making business decisions and it appears that he may have inadvertently misinterpreted PNM's testimony as detailed above. I have addressed these misunderstandings through comprehensive system modeling and resource planning analysis, which show that Staff's criticism of PNM's application with respect to CCUS is undeserved, and that abandoning the San Juan coal plant is in the best interest of PNM's customers.

III. RESPONSE TO CCAE/SJCA/DINE CARE

Q. PLEASE SUMMARIZE CCAE, SJCA, AND DINE CARE'S CONCLUSIONS AND RECCOMENDATIONS CONTAINED IN THE TESTIMONY OF THEIR WITNESS JASON SCHWARTZ.

A. CCAE, SJCA and DINE CARE support the abandonment of the San Juan coal plant. The criticism raised by Witness Schwartz is simply that PNM understates by billions of dollars the shutdown of the coal plant because PNM did not properly account for global environmental externalities. Witness Schwartz recommends that the NMPRC require PNM to incorporate a Social Cost of Carbon when evaluating resource alternatives and that the Social Cost of Carbon should be based on the federal Interagency Working Groups estimates. CCAE, SJCA and DINE CARE believe that by doing so, New Mexico would become a climate leader.[25]

Q. DO YOU AGREE WITH WITNESS SCHWARTZ?

A. PNM agrees with Witness Schwartz that the best decision for PNM's customers is to abandon its share in the San Juan coal plant as proposed in the application PNM filed in the case. As stated in my Direct Testimony, the abandonment analysis was conservative and the savings could very well be more than reported in my Direct Testimony. However, PNM disagrees with including a Social Cost of Carbon in this or any future analysis.

[25] Direct Testimony of Jason Schwartz at Page 3-5, Page 31 Lines 11-12

Q. PLEASE EXPLAIN WHY YOU DISAGREE WITH INCORPORATING A SOCIAL COST OF CARBON AS PART OF THE MODELING ANALYSIS.

A. There are a few reasons. First, Witness Schwartz argues that the IRP requirements [in which the Commission instructs utilities to determine the most cost-effective resource portfolio and alternative portfolios by considering certain factors, including "existing and anticipated environmental laws and regulations, and, if determined by the commission, the standardized cost of carbon emissions."[26]] could be interpreted to require use of a Social Cost of Carbon rather than a proxy cost for compliance with environmental regulation.[27] The Commission addressed this, in Case No. 06-00448-UT. In that case, the Commission mandated the use of standardized prices for carbon emissions for use in IRPs beginning in 2010, based on workshops addressing relevant factors, such as, the risk of future regulation, trading prices for carbon allowances in established national and international markets, and state policies regarding greenhouse gas reduction.[28] PNM utilized the Commission-authorized methods for consideration of carbon costs in its analyses in this case which do not include a Social Cost of Carbon. It would not be appropriate to now depart from established Commission standards and impose a vastly different method for considering carbon costs such as the Social Cost of Carbon.

[26] § 17.7.3.9(G)(2)(c) NMAC.
[27] Direct Testimony of Jason Schwartz at Page 10 Line 18 to Page 11 Line 3
[28] Case No. 06-00448-UT, *Final Order* (NMPRC June 19, 2007).

Second, the Energy Transition Act essentially renders the use of a Social Cost of Carbon excessive for PNM's planning practice and even renders CO_2 pricing in general unwarranted (unless an actual CO_2 tax is levied) because it is the regulatory requirement to reduce carbon emissions, not CO_2 pricing, that drive planning decisions. Incorporating a Social Cost of Carbon would have been an alternative mechanism to the approach adopted by the Energy Transition Act to advance carbon free energy in New Mexico. The passage of the Energy Transition Act sets one of the most aggressive timelines throughout the nation for a carbon-free energy supply by 2045 and PNM has taken this a step further by self-imposing a goal of carbon free generation by 2040. Consequently, imposing any price on carbon whether via a pseudo carbon tax or Social Cost of Carbon is redundant and therefore unnecessary given the Energy Transition Act.

Third, when presenting the results of a resource planning analysis, PNM focuses on the NPV of utility revenue requirements as the cost basis. Adding externalities beyond the costs actually charged to customers distorts the economics of the decision from a utility cost – and thereby a utility customer cost basis.

Finally, Witness Schwartz references Xcel, a utility in Colorado and its use of SCC in planning – which was the result of a recent piece of legislation. Had the New Mexico Legislature intended for additional global externalities be considered by the NMPRC, a Social Cost of Carbon requirement would have been legislated in the Energy Transition Act – and it was not.

IV. CONCLUSION

Q. PLEASE SUMMARIZE YOUR TESTIMONY?

A. Staff Witness Solomon's recommendations are predicated upon a pre-feasibility report that is not suitable for making business decisions and it appears that he may have inadvertently misinterpreted PNM's testimony as detailed above. I have addressed these misunderstandings through comprehensive system modeling and resource planning analysis, which show that Staff's criticism of PNM's application with respect to CCUS is undeserved, and that abandoning the San Juan coal plant is in the best interest of PNM's customers.

Incorporating a Social Cost of Carbon in this case (and future Commission proceedings) is a departure from existing Commission standards and is not needed to advance carbon-free energy in New Mexico due to the passage of the Energy Transition Act. The Energy Transition Act has positioned New Mexico and PNM to be leaders in carbon-free energy by setting one of the most aggressive timelines in the nation to achieve a carbon-free energy supply by 2045. PNM has taken this policy a step further by self-imposing a goal of carbon-free generation by 2040.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes it does.

GCG#526366

Assumptions for the San Juan coal plant CCUS 1

PNM Exhibit NLP-1 (Rebuttal)

Is contained in the following 1 page.

PNM Exhibit NLP-1 (Rebuttal)

		CCUS (PNM Share) 70% SJGS CF - 85% CCUS LF	Source
Total Project Cost ($2022)	$	**794,757,738**	S&L 2019
WACC		7.20%	PNM
Depreciable Life	Years	17	PNM
Annual O&M Cost ($2023)	$/yr	**26,193,654**	S&L 2019
Fixed	$/yr	7,697,605	S&L 2019
Variable	$/yr	18,496,049	S&L 2019
Demin Makeup Water	$/yr	18,684	S&L 2019
Water Treatment	$/yr	516,910	S&L 2019
CO2 Island Chemical and Disposal Costs	$/yr	17,960,455	S&L 2019
Annual CapEx	$/Yr	**7,947,577**	PNM
Existing Net Capacity (Units 1& 4 Combined)	MW	497	PNM
Total CCUS Parasitic Load	MW	145	S&L 2019
CCUS Process Load Factor	%	85%	S&L 2019
Additional Annual Energy Requirements	*MWh*	1,079,670	Calculated
Capture Rate	%	90%	S&L 2019
SJGS Emission Rate	MT/MWh	0.99	PNM
Annual Emissions (70% CF)*	MT	3,016,335	Calculated
Annual Emissions Captured*	MT	2,714,701	Calculated
EOR Revenues	$/Tonne	$20	S&L 2019
45Q Tax Credit**	$/Tonne	$27.61 - $39.43	S&L 2019 / IRS
Inflation	%	1.50%	PNM

Capital and O&M costs presented in the S&L 2019 study were esclated to $2023 at 1.5% inflation

* approximate value, actual values modeled vary with dispatch

** 45Q tax credits must be grossed up for marginal income taxes

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF PUBLIC SERVICE COMPANY OF NEW MEXICO'S ABANDONMENT OF SAN JUAN GENERATING STATION UNITS 1 AND 4	))))	**Case No. 19-00018-UT**

AFFIDAVIT

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

NICHOLAS PHILLIPS, Director, Integrated Resource Planning, at Public Service Company of New Mexico, upon being duly sworn according to law, under oath, deposes and states: I have read the foregoing **Rebuttal Testimony of Nicholas Phillips** and it is true and correct based on my personal knowledge and belief.

SIGNED this 14th day of November, 2019.

NICHOLAS PHILLIPS

SUBSCRIBED AND SWORN to before me this 14th day of November, 2019.

NOTARY PUBLIC IN AND FOR
THE STATE OF NEW MEXICO

My Commission Expires:

1.21.2020

GCG#526313