

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

**IN THE MATTER OF PUBLIC SERVICE)
COMPANY OF NEW MEXICO'S)
CONSOLIDATED APPLICATION FOR)
APPROVALS FOR THE ABANDONMENT,)
FINANCING, AND RESOURCE REPLACEMENT)
FOR SAN JUAN GENERATING STATION)
PURSUANT TO THE ENERGY TRANSITION ACT)**

Case No. 19-00195-UT

REBUTTAL TESTIMONY

OF

NICHOLAS L. PHILLIPS

January 13, 2020

**NMPRC CASE NO. 19-00195-UT
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NICHOLAS L. PHILLIPS**

**WITNESS FOR
PUBLIC SERVICE COMPANY OF NEW MEXICO**

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PNM Exhibit NLP-1 (Rebuttal) Assumptions for the San Juan coal plant CCUS 1

AFFIDAVIT

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1

I. INTRODUCTION

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

3 **A.** My name is Nicholas L. Phillips. I am the Director of Integrated Resource
4 Planning for Public Service Company of New Mexico (“PNM” or “Company”).
5 My address is 414 Silver Avenue, SW, Albuquerque, New Mexico 87102.

6

7 **Q. HAVE YOU PREVIOUSLY FILED TESTIMONY IN THIS DOCKET?**

8 **A.** Yes. I filed Direct Testimony in support of consolidated PNM’s application on
9 July 1, 2019. I also filed Direct Errata Testimony on September 20, 2019.

10

11 **Q. WHAT IS THE PURPOSE OF YOUR REBUTTAL TESTIMONY?**

12 **A.** The purpose of my Rebuttal Testimony is to provide the Company’s overall
13 evaluation of the resource replacement proposals submitted by intervenors in their
14 direct testimonies and explain why the Company continues to support PNM
15 Scenario 1 from a resource planning perspective. I also respond to a number of
16 specific issues and proposals raised by Utility Division Staff (“Staff”) and
17 intervenors regarding PNM’s modeling process and the assumptions we used in
18 our replacement resource analysis. I emphasize that if I do not respond to a
19 specific argument or alternative proposal, that should not be interpreted as
20 agreement with that argument or proposal.

21

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1 **II. PNM’S EVALUATION OF REPLACEMENT RESOURCE PROPOSALS**

2 **Q. WHAT IS YOUR MAIN TAKEAWAY AFTER REVIEWING THE**
3 **DIRECT TESTIMONY IN THIS DOCKET?**

4 **A.** My main takeaway is that the wide range of portfolios presented by many
5 intervenorors are not based on fundamental resource planning principles. Instead,
6 these proposals are results-driven and reflect the ultimate policy or business goals
7 of each of the intervenors. All of the comprehensive portfolios proffered by the
8 intervenorors would increase costs to PNM’s customers and decrease system
9 reliability. Other intervenors do not present portfolios that would be immediately
10 available upon the abandonment of the San Juan coal plant. Instead, they
11 recommend a “wait and see” approach that would also result in higher costs for
12 PNM’s customers and/or lower reliability.

13
14 **Q. PNM WITNESS FALLGREN STATES THAT THE COMPANY**
15 **CONTINUES TO RECOMMEND PNM SCENARIO 1 AFTER**
16 **REVIEWING THE DIRECT TESTIMONY IN THIS DOCKET. WHY**
17 **DOES THE COMPANY BELIEVE THAT SCENARIO 1 IS THE BEST**
18 **OPTION FROM A RESOURCE PLANNING PERSPECTIVE?**

19 **A.** PNM is recommending Scenario 1 because it ensures reliability, serves as a
20 critical pathway for the Company to achieve 100 percent carbon-free energy by
21 2040, and minimizes overall risk (including technology risk) at the lowest
22 reasonable cost. PNM Scenario 1 is also the best option because it balances these

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1 needs with the preferences and requirements of the Energy Transition Act. The
2 proposed battery storage facilities in PNM Scenario 1 will provide new flexible
3 resources that can be charged when it is economic to do so (including reductions
4 in system curtailments) and discharged when energy is required to serve load.
5 The proposed solar resources will provide low-cost energy for PNM’s customers.
6 The addition of natural gas units at the Pinon Gas Plant will provide necessary
7 firm capacity to meet customer demands during peak hours and new, flexible
8 generation that helps meet reliability requirements as PNM’s energy portfolio
9 evolves. These gas units will also serve as critical flexible back-up capacity and,
10 in conjunction with battery storage, will support the integration of additional
11 renewables and facilitate the Company’s overall transition to carbon-free
12 resources.

13
14 **Q. IS PNM’S APPROACH CONSISTENT WITH THE REQUIREMENTS OF**
15 **THE ENERGY TRANSITION ACT AND THE COMPANY’S GOAL TO**
16 **BE CARBON-FREE BY 2040?**

17 **A.** Yes. PNM Scenario 1 represents a significant first step in the Company’s
18 transition to comply with New Mexico’s carbon-free energy requirements under
19 the Energy Transition Act. PNM Scenario 1 consists of 350 MW of solar, 130
20 MW of battery storage, and 280 MW of natural gas resources. If the Commission
21 approves the abandonment of the San Juan coal plant, in the first full year
22 following abandonment (*i.e.*, 2023) PNM will be producing nearly 34 percent of
23 its energy for retail customers from renewable resources. This would put PNM

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1 well ahead of the state’s applicable 20 percent renewable portfolio standard
2 (“RPS”) at that time. Approximately 64 percent of the Company’s retail energy
3 will come from carbon-free resources at that time, as well.

4
5 It is also important to keep in mind that this energy transition is not going to
6 happen overnight. The resource mix that is being proposed under PNM Scenario
7 1 will help move the Company toward a more environmentally-conscious and
8 sustainable system in a way that keeps costs low for customers. But it is only a
9 first step. In 2020, PNM will submit its triennial Integrated Resource Plan
10 (“IRP”), and this plan will identify the next steps in this transition. If the 2020
11 IRP identifies any needs during the four-year action period, PNM will issue a
12 request for proposals (“RFP”) that will take advantage of further technology
13 improvements and price declines for low- or zero-carbon resource options.
14 During the next phase of the energy transition, PNM also does not anticipate the
15 same thresholds on the amount of energy storage capacity that could be added to
16 the Company’s system. The 130 MW limit for battery storage in this case applies
17 only to the resources replacing the San Juan coal plant.¹ To ensure that PNM and
18 the State of New Mexico can responsibly execute this transition, a balanced and
19 measured approach that ensures the continuation of reliable electric service at the
20 lowest reasonable cost to PNM’s customers will best meet the objectives of the
21 Energy Transition Act.

¹ PNM Witnesses Fallgren and Kemp discuss the rationale for PNM’s determination of the appropriate level of initial battery storage during the first phase of the transition.

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1 **Q. PLEASE SUMMARIZE THE RESOURCE REPLACEMENT**
2 **PORTFOLIOS RECOMMENDED BY OTHER INTERVENORS.**

3 **A.** The San Juan Entities (*i.e.*, the Board of County Commissioners for the County of
4 San Juan and the City of Farmington) and Westmoreland Mining LLC
5 (“Westmoreland”) recommend that the Commission require sufficient flexibility
6 in any approved plan so that PNM could possibly enter into a potential purchased
7 power agreement (“PPA”) with Enchant Energy Corporation (“Enchant Energy”) for the purchase of energy from the San Juan coal plant retrofitted with expensive
8 Carbon Capture Utilization and Sequestration (“CCUS”) technology.

10

11 The Coalition for Clean Affordable Energy (“CCA”) submits two replacement
12 resource portfolios. CCA’s preferred portfolio, which it identifies as “CCA 1,”
13 would replace PNM’s proposed Pinon Gas Facility with two additional
14 solar/battery projects, expand the battery capacity at the Arroyo site, and expand
15 demand response and energy efficiency on PNM’s system.

16

17 Sierra Club principally recommends replacement resource portfolios with greater
18 amounts of renewable energy and battery storage, with no new gas generating
19 capacity. If the Energy Transition Act is interpreted not to restrict the location of
20 replacement resources to the Central Consolidated School District (“CCSD”),
21 Sierra Club recommends what it identifies as “Tier 1-13” in PNM’s SERVM
22 modeling. This portfolio would add 500 MW of solar and 450 MW of batteries.
23 If the Energy Transition Act is interpreted to require the first 450 MW of

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1 replacement resources to be located in the CCSD, Sierra Club recommends what
2 it identifies as portfolio “SC 12-1/12-2.” This portfolio would add 550 MW of
3 solar (of which 400 MW are in the CCSD) and 450 MW of batteries (of which 70
4 MW are in the CCSD). In the alternative, Sierra Club recommends two portfolios
5 if the Commission decides to approve new gas capacity as part of a resource
6 replacement portfolio. The first portfolio, which Sierra Club identifies as “SC 5-
7 1B/6-1A,” would include 154 MW of new gas generation. The second portfolio,
8 which Sierra Club identifies as “Tier 2-7” in PNM’s SERVVM modeling, would
9 include 77 MW of new gas generation.

10
11 New Mexico Affordable Reliable Energy Alliance (“NM AREA”) was generally
12 supportive of PNM Scenario 1, subject to its request for a conditional approval of
13 PNM’s legacy Incremental Interruptible Power Rate (“IIPR”), for which the
14 Commission has already established a review process in PNM’s next rate case.

15
16 Intervenor Greg Sonnenfeld asks the Commission to consider the approval of a
17 first-generation storage system provided by Energy Vault, a vendor that Mr.
18 Sonnenfeld represents, as part of PNM’s replacement resource portfolio.

19
20 Southwest Generation Operating Co., LLC (“SWG”) asserts that PNM has
21 proposed to over-procure new thermal resources and that other near-term
22 solutions should be considered, including SWG’s owned-and-operated Valencia
23 Energy Facility (“VEF”).

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1 Western Resource Advocates (“WRA”) recommends that the Commission
2 approve the Jicarilla and Arroyo solar projects recommended under PNM
3 Scenario 1. WRA further recommends that the Commission approve a 40 MW 2-
4 hour battery at the Sandia substation and a 30 MW 2-hour battery at the Zamora
5 substation, with final approval pending a new competitive RFP for these facilities
6 that allows bidders to propose contractual arrangements that provide PNM full
7 operational control of those facilities. WRA acknowledges that these
8 recommended resources will be not be sufficient to create the portfolio necessary
9 to maintain reliable service upon the abandonment of the San Juan coal plant, and
10 that additional resources will be required.

11
12 Finally, New Energy Economy (“NEE”) and Prosperity Works oppose the
13 inclusion of natural gas in any replacement resource portfolio. Neither of these
14 organizations, however, recommend a replacement resource portfolio.

15
16 **Q. WHAT IS STAFF’S POSITION?**

17 **A.** Staff recommends that PNM be required to amend its application and provide an
18 analysis of CCUS technology under the Enchant Energy venture that is being
19 considered (*i.e.*, CCUS with Section 45Q tax credits and the sale of CO₂ for
20 Enhanced Oil Recovery). In the alternative, Staff recommends revised PNM
21 Scenario 2 based on Staff’s view that this replacement resource portfolio will
22 maximize service reliability and minimize the economic impacts to San Juan
23 County. Revised PNM Scenario 2 would replace the San Juan coal plant with 440

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1 MW of natural gas at the Pinon Gas Plant and a 100 MW/30 MW hybrid
2 solar/battery facility.

3

4 **Q. HAVE ANY OF THE INTERVENORS PRESENTED A CASE THAT HAS**
5 **CAUSED THE COMPANY TO MODIFY ITS RECOMMENDATION OF**
6 **PNM SCENARIO 1?**

7 **A.** No, they have not. PNM has evaluated the portfolios submitted by the intervenors
8 and their respective testimonies regarding the Company's recommended resource
9 portfolio. The stark divergence across the intervenors' proposals reinforces
10 PNM's conclusion that PNM Scenario 1 is the best option when it comes to
11 balancing reliability, cost, local community support, and environmental attributes.
12 None of the intervenors proposals are lower cost and more reliable than PNM
13 Scenario 1.

14

15 **Q. PLEASE DESCRIBE THE MODELING PROCESS PNM USED TO**
16 **DETERMINE THAT REPLACEMENT RESOURCES PROPOSED AS**
17 **PNM'S SCENARIO 1 ARE PROVIDED AT THE LOWEST**
18 **REASONABLE COST.**

19 **A.** As I discussed in my Direct Testimony, PNM's resource evaluation was a
20 coordinated effort among PNM and two independent consultants, Astrapé
21 Consulting, LLC ("Astrapé"), and Ascend Analytics, LLC ("Ascend"). PNM
22 used the EnCompass modeling tool to perform its expansion planning analysis.
23 Each of the outside consultants' analyses used their own modeling tools and to

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1 some degree their own assumptions. Astrapé used its proprietary Strategic
2 Energy Risk Valuation Model (“SERVM”) model and Ascend used its
3 commercial PowerSimm model.² Each of the three models that were used have
4 different capabilities and attributes. Accordingly, PNM and its consultants
5 engaged in an iterative process to ensure that portfolios minimized cost while
6 meeting reliability requirements and accounting for PNM’s technology risk for
7 battery storage. For this application, the results of PNM’s analyses have been
8 presented through three different sets of Net Present Values (“NPVs”) and two
9 different sets of reliability criteria. The results of all three of these models
10 demonstrated that PNM Scenario 1 will meet reliability and technology risk
11 criteria at the lowest reasonable cost, while meeting or exceeding the
12 environmental standards set forth in the Energy Transition Act.

13
14 **Q. DO YOU HAVE ANY OTHER COMMENTS REGARDING THE**
15 **MODELING PROCESS THAT LED TO THE COMPANY’S**
16 **RECOMMENDATION OF PNM SCENARIO 1?**

17 **A.** Yes. I want to highlight that the record before the Commission on proposed
18 replacement resources is the result of an open and transparent modeling process.
19 Because of the significance of this first step under the Energy Transition Act for
20 the abandonment of the San Juan coal plant, the Commission has taken steps in

² The specific criticisms of SERVM and PowerSimm in the intervenors’ direct testimony are addressed by PNM Witnesses Wintermantel (SERVM) and Dorris (PowerSimm).

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1 this proceeding to make sure that extensive modeling capability was provided to
2 all parties. In July 2019, the Commission issued an order that directed PNM to
3 file a modeling proposal to make sure parties would have access to the models,
4 either by running scenarios themselves or by having PNM run those scenarios for
5 them.³ The direct testimony filed by intervenors confirms that PNM Scenario 1
6 remains the lowest cost and most reliable portfolio presented to the Commission
7 and is in the best interests of PNM’s customers. This resource portfolio is a
8 responsible and measured first step in the New Mexico energy transition that
9 results in numerous benefits for the state and the communities we serve. These
10 benefits include reducing carbon emissions by 62 percent from 2005 levels,
11 meeting established reliability criteria, reducing costs to customers, facilitating
12 the integration of additional renewable resources, and exceeding the updated RPS
13 requirements through 2024.

14
15 **Q. WHAT ARE YOUR GENERAL OBSERVATIONS REGARDING THE**
16 **REPLACEMENT RESOURCE PORTFOLIOS RECOMMENDED BY**
17 **SOME OF THE ENVIRONMENTAL ADVOCATES?**

18 **A.** I have several observations. First, some of the environmental advocates (*i.e.*,
19 CCAIE and Sierra Club) are principally recommending “no new gas” proposals
20 that would require PNM to move as quickly as possible toward a carbon-free
21 resource mix. These proposals, which include a combination of renewables and

³ In addition, PNM hosted several modeling meetings with its experts to educate the parties on how the models used by PNM work.

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1 battery storage, would result in a significantly higher amount of total capacity
2 than the Company is proposing under PNM Scenario 1. This additional capacity
3 would result in higher costs to customers and higher reliability risks.

4
5 **Q. CAN YOU PROVIDE AN EXAMPLE?**

6 **A.** Yes. As explained by CCAE Witness Sommer, CCAE's proposal includes
7 expanded capacity at the Arroyo solar/battery facility, replaces the Pinon Gas
8 Plant with two solar/battery plants, and adds incremental demand response to
9 PNM's system. As I discuss below, PNM believes that CCAE has incorporated
10 several unrealistic assumptions into its proposals and they are therefore
11 significantly more expensive than CCAE represents. Even if you were to take all
12 of CCAE's assumptions at face value, however, CCAE's portfolios would cost
13 between \$72 and \$149 million more than PNM's Scenario 1 on an NPV basis and
14 have higher loss of load probabilities.⁴

15
16 **Q. WHAT ARE YOUR OTHER OBSERVATIONS?**

17 **A.** First, CCAE (and to a lesser extent Sierra Club) continuously modified basic
18 assumptions in an apparent attempt to bolster their proposals from a reliability
19 standpoint.⁵ PNM disagrees with these assumptions and PNM Witness

⁴ See Sommer Corrected Direct Testimony, Table 1.

⁵ Sierra Club modified the amount of demand response included in one of its alternative proposals and included larger amounts of battery storage in all of its alternative proposals. Additionally, Sierra Club raised similar concerns to those of CCAE related to the Equivalent Forced Outage Rate ("EFOR") at Four Corners Power Plant and the import limit assumed in the SERVVM model. However, Sierra Club did not incorporate these assumptions into its alternative portfolios.

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1 Wintermantel discusses the reliability analysis of CCAE Scenario 1 if these
2 assumptions are restored. However, even if you were to take them at face value
3 PNM Scenario 1 would still have superior reliability metrics at a lower cost.

4
5 The environmental advocates' proposals would also result in greater technology
6 risk associated with installing larger batteries and adding too much battery
7 capacity to PNM's portfolio too quickly. These proposals also increase price risk
8 given that battery prices are forecasted to decline. Although these issues are
9 discussed in detail by PNM Witnesses Fallgren, Kemp, and Dorris, I would add
10 that if intervenors' proposals were consistent with PNM's capacity
11 recommendations for the size of any given battery storage project not exceeding
12 40 MW, their recommended portfolios would be even more expensive due to a
13 loss of economies of scale.

14
15 The environmental advocates also question PNM's determination of the
16 appropriate level of initial battery storage technology and suggest that this led to
17 the selection of a resource portfolio that is less than optimal. Although I address
18 this issue more fully later in my testimony, I would highlight at the outset that
19 PNM's determination of the appropriate level of battery storage in no way
20 influenced the amount of natural gas resources included in PNM Scenario 1.
21 Throughout all of PNM's modeling, the Pinon Gas Plant was selected as part of
22 the lowest reasonable cost portfolio that meets reliability requirements.

23

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1 **Q. DO YOU HAVE ANY COMMENTS REGARDING THE ANALYSES**
2 **PRESENTED BY THE ENVIRONMENTAL ADVOCATES TO SUPPORT**
3 **THEIR PROPOSALS?**

4 **A.** Yes, I have two primary comments. My first comment is that CCAE presents its
5 cost estimates based solely on EnCompass modeling results and not SERVUM,
6 which presents a partial view of the overall analysis. As I discussed in my Direct
7 Testimony, each of the three models utilized by PNM have strengths and
8 weaknesses and no single model can do it all. Meeting reliability standards and
9 the costs associated with integrating renewable resources and battery storage
10 (intra-hour balancing, as well as intra-hour resource ramping while maintaining
11 adequate operating reserves) are not completely captured within EnCompass;
12 however, they are fully captured in SERVUM. Discounting these factors can
13 understate the true cost of a portfolio and lead to the selection of a suboptimal
14 portfolio from a reliability perspective. Consequently, a singular focus on a given
15 model does not capture the entire picture.

16
17 My second comment is that some intervenors are supporting proposals that would
18 result in only a partial replacement of the resources at the San Juan coal plant.
19 For example, WRA recommends Commission approval of the two PPAs for
20 Arroyo and Jicarilla as well as conditionally approving the Sandia and Zamora
21 storage projects, without identifying what else WRA supports to fill the remaining
22 capacity need. This pick-and-choose approach is contrary to resource planning
23 principles. Resource planning needs to be evaluated on a full portfolio basis. It is

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1 not reasonable to expect PNM to take the first step in the state’s energy transition
2 without a full replacement portfolio in place to meet anticipated customer needs.

3

4 **Q. WHY DOES RESOURCE PLANNING NEED TO BE EVALUATED ON A**
5 **FULL PORTFOLIO BASIS?**

6 **A.** PNM operates its system as an integrated portfolio and each component of that
7 portfolio serves a purpose. To ensure that the portfolio will operate efficiently
8 and reliably, PNM needs to evaluate all pieces of the portfolio simultaneously to
9 ensure cohesiveness. Without this process and evaluation, the outcome will be a
10 suboptimal portfolio that can lead to higher customer costs and reliability risks.
11 In this regard, resource selection is much more like completing a jigsaw puzzle
12 (which involves looking for the unique characteristics and shapes that will help
13 complete the puzzle) rather than swapping out Lincoln Logs. For this reason, it
14 would be wrong to think that, for example, the Pinon Gas Plant can simply be
15 swapped out for other resources, such as a CCUS-retrofitted San Juan coal plant.

16

17 **Q. PLEASE EXPLAIN WHY THE PINON NATURAL GAS PLANT CANNOT**
18 **SIMPLY BE SWAPPED OUT FOR OTHER RESOURCES, SUCH AS A**
19 **CCUS-RETROFITTED SAN JUAN COAL PLANT?**

20 **A.** The easiest way to understand this concept is by way of an example. Consider a
21 portfolio that is a variant of PNM Scenario 1 whereby the proposed 280 MW
22 Pinon Gas Plant is “swapped out” for an equivalent-sized, hypothetical 280 MW

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1 PPA from the San Juan coal plant retrofitted with CCUS.⁶ While this portfolio
2 may not seem different than PNM Scenario 1 on its face, due to the differences in
3 operational characteristic of the two resources, swapping out the gas units for this
4 PPA would cause the portfolio to exceed the targeted Loss of Load Expectation
5 (“LOLE”) threshold by a factor of three. This means that PNM would need to
6 invest in additional resources to bring the portfolio within reliability standards
7 (thereby increasing costs to customers) or PNM would have to operate a system
8 that does not meet reliability criteria (thereby increasing the risks of a reliability
9 event). Furthermore, the lack of flexibility provided by this portfolio would also
10 have a negative impact on PNM’s ability to integrate renewable resources, which
11 in turn will lead to increased costs to PNM’s customers as the energy transition
12 continues. In sum, swapping out the Pinon Gas Plant for a PPA placeholder from
13 a CCUS-retrofitted San Juan plant would result in significant reliability and price
14 risks for PNM’s customers.

15
16 **Q. SEVERAL ENVIRONMENTAL ADVOCATES CONTEND THAT THE**
17 **COMMISSION SHOULD NOT APPROVE NEW NATURAL GAS**
18 **PLANTS. WHAT IS YOUR RESPONSE?**

⁶ The PPA is assumed to be a take-or-pay, unit-contingent, firm contract, which means that whenever the San Juan coal plant is available it will deliver 280 MW to PNM, but PNM is responsible for replacement capacity and energy whenever the coal plant is offline due to a planned or forced outage. As more fully discussed by PNM Witnesses Wintermantel and Maestas, if outages were to occur during peak load periods PNM would face significant market risk, both in terms of the Company’s ability to secure firm capacity and energy and the associated price for that capacity and energy. PNM also assumed for this analysis that the operating characteristics of the San Juan plant (such as Equivalent Availability Factor (“EAF”), ramp rates, etc.) are unaffected by the CCUS retrofit. This is a conservative assumption, as CCUS is likely to have a negative impact on the availability and flexibility of the San Juan plant.

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1 **A.** I believe that excluding new and flexible natural gas replacement resources would
2 be short-sighted and unnecessarily risky. Based on PNM’s analyses, the Pinon
3 Gas Plant is an essential pathway that will help PNM maintain system reliability
4 during unforeseen weather events. In conjunction with battery storage
5 technology, Pinon Gas Plant is also an essential component of a resource portfolio
6 that minimizes cost and risk.

7

8 **Q.** **DOES THE ENERGY TRANSITION ACT STATE A PREFERENCE FOR**
9 **RESOURCES WITH THE LEAST ENVIRONMENTAL IMPACTS, AS**
10 **SEVERAL INTERVENORS SUGGEST?**

11 **A.** It does, along with other factors that the Commission is charged with considering
12 under the Act. However, I do not believe the Energy Transition Act alters PNM’s
13 general planning practices, which seek to balance cost, reliability and the impact
14 to the environment. This approach is consistent with the Commission’s IRP rule,
15 which requires utilities to select resources that have greater environmental
16 attributes if PNM is evaluating resource alternatives that are equal when it comes
17 to reliability and cost. For this reason, we agree with NMAG Witness Crane
18 when she states that “the requirement for ‘least environmental impact’ must
19 necessarily be weighed against the operational and reliability requirements of the
20 electric system.”⁷ PNM has weighed the environmental impact of replacing a
21 portion of the San Juan coal plant capacity with lower-emission gas units to

⁷ Crane Direct Testimony at 13:16-17.

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1 protect against the possibility of extended periods of low renewable production.

2 We have concluded that these low-cost gas units are needed to maintain system
3 reliability as the energy transition occurs.

4
5 **Q. DO YOU HAVE ANY OTHER COMMENTS REGARDING THE NO NEW
6 GAS PROPOSALS?**

7 **A.** I do. PNM is proposing gas units that can ramp up to full capacity in
8 approximately ten minutes and are expected to operate at a low capacity factor.
9 The carbon footprint associated with these units is small. In fact, the difference
10 in carbon emissions between CCAE's preferred portfolio and PNM Scenario 1 is
11 approximately 0.4 percent per year from 2022-2038 on a systemwide basis.

12
13 It is also important to remember that the Energy Transition Act directly requires
14 PNM and other utilities to reduce and eventually eliminate carbon emissions
15 through a series of RPS standards that lead up to the Act's carbon-free mandate in
16 2045. PNM agrees that it is a worthy goal to eliminate carbon emissions from our
17 resource mix as soon as possible. This is why the Company has moved up the
18 goalposts and is charting a course to eliminate carbon emissions from our
19 resource mix by 2040. In this regard, as of July 2019 PNM was identified as only
20 one of nine electric utilities in the U.S. that had announced that it was going

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1 carbon-free, and the Company’s 2040 goal was the earliest announced target date
2 for a utility of our size.⁸

3
4 Given PNM’s goal to achieve zero percent carbon in 2040, the Company does not
5 believe that it would be reasonable to require customers to pay \$72 to \$149
6 million or more (as proposed by CCAE) and put our system’s reliability at risk for
7 a marginal reduction in carbon emissions. As PNM Witness Fallgren discusses in
8 his Rebuttal Testimony, getting the first step of the energy transition right from a
9 reliability standpoint is critically important to ensure that PNM can achieve its
10 longer-term goal in 2040. In addition, PNM Witness Dorris discusses his
11 involvement with other utilities that are moving toward zero-carbon energy and
12 how the proposed Pinion Gas Plant can be used to both facilitate the first step in
13 PNM’s transition and its potential to be used as a carbon-free resource in the
14 future.

15
16 **Q. WHAT IS THE COMPANY’S POSITION ON SIERRA CLUB’S**
17 **PROPOSALS FOR “LESS NEW GAS”?**

⁸ See *PNM among few private utilities with 100% renewable goal*, THE SANTA FE NEW MEXICAN (Jul. 2, 2019), <https://www.energycentral.com/news/pnm-among-few-private-utilities-100-renewable-goal>. The two other utilities mentioned in this article as having announced carbon-free goals before 2040 (Green Mountain Power in Vermont and Platte River Power Authority in Fort Collins, Colorado) both serve significantly fewer customers than PNM. See Green Mountain Power, *2018 Integrated Resource Plan*, at 4-6 (projecting 266,000 retail customers for the year 2020), <https://greenmountainpower.com/wp-content/uploads/2019/03/IRP-Declining-Electricity-Demand.pdf>; Jacy Marmaduke, *Fort Collins power provider commits to cut all carbon emissions by 2030*, FORT COLLINS COLORADOAN (Dec. 6, 2018) (stating that “Platte River’s service area includes about 342,000 people”), <https://www.coloradoan.com/story/news/2018/12/06/northern-colorado-utility-commits-100-percent-renewable-electricity/2215172002/>.

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1 **A.** Relative to PNM Scenario 1, these proposals do not strike a reasonable balance
2 because they increase: (1) the cost to customers; (2) the probability of a reliability
3 event; and (3) technological risk.

4

5 **Q. WHAT ARE YOUR OBSERVATIONS REGARDING THE**
6 **REPLACEMENT RESOURCES RECOMMENDED BY OTHER**
7 **INTERVENORS?**

8 **A.** As PNM Witness Fallgren explains, the proposals submitted by SWG, the San
9 Juan Entities, Westmoreland, and to some extent NM AREA are based on a “wait
10 and see” approach. These proposals should be rejected because there is a pressing
11 need to replace the lost capacity from the San Juan coal plant and for the
12 Company to move forward in executing the energy transition.

13

14 PNM Witnesses Maestas and Wintermantel address the availability, deliverability,
15 flexibility and reliability issues associated with SWG’s proposal. I would add that
16 SWG did not request any modeling runs that would enable it to assess whether its
17 proposal for short-term capacity purchases in the market and battery storage
18 might result in cost savings or reliability issues for PNM and its customers.
19 Instead, the only modeling request SWG submitted to PNM appeared to be
20 directed toward evaluating the possibility of extending the PPA for capacity at the
21 VEF beyond 2028, when the PPA between PNM and SWG expires.

22

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1 The San Juan Entities and Westmoreland recommend that PNM ignore the results
2 of a robust competitive bidding process in order to see what might emerge with a
3 speculative San Juan CCUS project. Waiting to see whether this project will
4 materialize would not be prudent because PNM requires firm resources in 2022 to
5 ensure that there are sufficient resources to meet the capacity and energy needs of
6 our customers in a reliable manner. Furthermore, the analysis I described earlier
7 in my Rebuttal Testimony demonstrates that a PPA from San Juan would not be a
8 workable substitute for the Pinon Gas Plant due to reliability and price risks, and
9 would diminish PNM’s ability to integrate renewable resources on its system.
10 This would be inconsistent with the intent of the Energy Transition Act.

11
12 Going forward, if Enchant Energy were to respond to a future RFP and offer a
13 PPA, PNM will evaluate that offer against all other competing bids and assess
14 whether the pricing and other attributes (such as the flexibility of the PPA and
15 PNM’s ability to meet RPS and other requirements) would be optimally met by
16 such a PPA as compared to other resources. If PNM does not have a meaningful
17 opportunity to evaluate a firm offer and assess any risks associated with the PPA
18 as compared to other alternatives, it would be potentially harmful to PNM’s
19 customers if PNM must “wait and see” what materializes with Enchant Energy
20 rather than securing competitively-priced, firm resources that can be delivered to
21 PNM’s customers by June 2022. To ensure that Enchant Energy is given the best
22 chance to compete in a future RFP, PNM recommends that Enchant Energy
23 provide indicative terms and conditions of a PPA (including price and product

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1 attributes) so that PNM may fully evaluate through the 2020 IRP whether a
2 CCUS-retrofitted San Juan coal plant could be included in the most cost-effective
3 portfolio for the next phase of the energy transition.

4
5 NM AREA contends that PNM did not give sufficient consideration to
6 incremental resource changes to its portfolios, including reforming and potentially
7 expanding its Rider No. 8 IIPR in order to reduce its need for replacement
8 resources for SJGS Units 1 and 4. NM AREA further contends that the
9 replacement of one of the seven proposed Pinon aeroderivative combustion
10 turbine generators within PNM's Scenario 1 with an equivalent level of properly
11 reformed and expanded IIPR load would potentially be cost-effective for
12 customers. However, Rate Rider No. 8 is closed to new customers and, as it
13 currently stands, the IIPR provides no value to the system in the context of
14 resource planning.⁹ It would be inappropriate for the Commission to accept NM
15 AREA Witness Dauphinais' recommendation to condition the approval of the
16 Pinon project based on PNM, in its next general rate review, reforming and
17 attempting to expand participation in the IIPR such that it can be relied upon in
18 resource planning. PNM Witness Settlage discusses the 2015 and 2016 PNM
19 Rate Case decisions regarding the IIPR and why NM AREA's proposal attempts
20 to circumvent those decisions. Only after parties have had a chance to weigh in

⁹ NM AREA Witness Dauphinais recognizes this when he recommends that substantial changes to the IIPR would have to be put in place by the Commission "such that it can be relied upon in PNM's resource planning..." Dauphinais Direct Testimony at 4:28-29.

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1 regarding Rate Rider No. 8 in the next rate proceeding will we know whether the
2 IIPR will continue, under what terms, and whether those terms will be sufficient
3 for PNM to rely upon the IIPR for resource planning.

4
5 Finally, PNM advises the Commission to reject Mr. Sonnenfeld's
6 recommendation to approve a first-generation system storage system provided by
7 Energy Vault. PNM has not been able to evaluate this technology because it was
8 not bid into the RFP. Allowing a resource to circumvent the competitive bidding
9 process could have the unintended consequence of leading to less competitive
10 RFPs in the future, which could lead to higher costs for PNM's customers. In
11 addition, this technology was included in the responses to PNM's new technology
12 request for information ("RFI") issued through the 2020 IRP process, and this is
13 the appropriate vehicle for PNM to consider this technology. PNM also notes that
14 Mr. Sonnenfeld has not presented any analysis demonstrating that this technology
15 is cost-competitive and would be a reliable component of PNM's portfolio.

16
17 **III. RESPONSE TO CCAE**

18 *A. Cost Estimates*

19 **Q. CCAE WITNESS SOMMER CLAIMS THAT CCAE'S PREFERRED**
20 **PORTFOLIO, CCAE SCENARIO 1, IS ONLY 1.37 PERCENT HIGHER**
21 **THAN PNM SCENARIO 1 ON AN NPV BASIS. WHAT IS YOUR**
22 **RESPONSE?**

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1 **A.** I have two responses. First, CCAE’s estimated percentage increase for CCAE
2 Scenario 1 is based on an NPV that is \$72 million higher than PNM Scenario 1.
3 However, this NPV significantly understates the true costs associated with CCAE
4 Scenario 1. CCAE has incorporated assumptions into its analysis that in
5 combination provide additional firm capacity and peak load reductions thereby
6 eliminating the need for an additional 119 MW of firm requirements for PNM.
7 These assumptions include: (1) an additional 16 MW of energy efficiency; (2) an
8 additional 31 MW of demand response; (3) a lower Equivalent Forced Outage
9 Rate (“EFOR”) at Four Corners Power Plant that would result in 22 MW
10 additional firm capacity available to meet peak load; and (4) approximately 50
11 MW of import capability. As I discuss below, PNM disagrees with all of these
12 assumptions. If all of CCAE’s adjustments are reversed an additional 119 MW of
13 firm capacity would need to be added to CCAE Scenario 1 to make it viable from
14 a reliability standpoint. Given CCAE’s stated desire for no new gas, the addition
15 of 119 MW of battery capacity would add approximately \$100 million of costs to
16 CCAЕ’s proposal on an NPV basis.¹⁰

17
18 Second, CCAE’s reported percentage difference is flawed as approximately 80
19 percent of total portfolio costs are shared across all portfolios. PNM is replacing
20 approximately 20 percent of its firm capacity and 30 percent of the energy used to
21 serve retail customers. The cost of the existing system adjusted for the San Juan

¹⁰ This assumes a \$100/kW-yr Demand Charge including Gross Receipts Tax. PNM has not modeled a detailed calculation of this “but for” scenario given how expensive CCAE’s portfolios already are.

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1 abandonment still far outweighs the costs of the replacement portfolio, especially
2 with the low prices received for the Pinon Gas Plant and the solar hybrid
3 resources in PNM Scenario 1. CCAE does not account for this when calculating
4 the percentile difference and presents a metric that makes the costs of the two
5 resource portfolios seem much closer than they actually are.

6

7 ***B. Energy Efficiency and Demand Response***

8 **Q. PLEASE PROVIDE AN OVERVIEW OF PNM'S ENERGY EFFICIENCY**
9 **AND DEMAND RESPONSE PROGRAMS.**

10 **A.** The Efficient Use of Energy Act (“EUEA”) specifies minimum energy savings
11 goals and budget levels for PNM’s energy efficiency and demand response
12 programs.¹¹ Verified savings through program year 2018 have resulted in a
13 cumulative savings of approximately 107 MW of coincident peak load reduction
14 since 2008. This corresponds to less than 10 MW of peak reduction per year, on
15 average, associated with energy efficiency programs. PNM’s internal energy
16 efficiency forecast expects to add an incremental 53 MW of peak reduction due to
17 energy efficiency programs by 2023, which is less than 11 MW per year on
18 average between program years 2019 and 2023.

19

¹¹ In 2020, PNM is required to achieve cumulative savings of 658 GWh, or 8 percent of 2005 retail sales. PNM’s verified cumulative energy savings through 2018 are 653 GWh.

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1 **Q. WHAT ENERGY EFFICIENCY AND DEMAND RESPONSE**
2 **ASSUMPTIONS DID CCAE MAKE IN ITS MODELING?**

3 **A.** With respect to energy efficiency, CCAE assumed an incremental coincidental
4 peak reduction of 16 MW attributable to energy efficiency programs above what
5 PNM assumed in its forecast. CCAE assumed approximately 14 MW per year
6 between 2019 and 2023, which is more than 40 percent higher per year than what
7 PNM has been able to achieve on average between 2008 and 2018. CCAE
8 assumed another 31 MW of peak reduction from demand response during PNM's
9 projected 2023 peak hour, doubling PNM's forecasted demand response available
10 in 2023. In total, CCAE's energy efficiency and demand response forecasts
11 would almost double PNM's peak reductions in less than half the time (5 years)
12 that it has taken PNM to achieve the 2018 savings (12 years).

13

14 **Q. BEFORE ADDRESSING CCAE'S SPECIFIC ASSUMPTIONS, DO YOU**
15 **HAVE ANY GENERAL COMMENTS REGARDING CCAE'S**
16 **RECOMMENDATIONS ON ENERGY EFFICIENCY AND DEMAND**
17 **RESPONSE?**

18 **A.** CCAE makes several overly-optimistic assumptions that have no relationship to
19 both the historical record and potential for PNM's energy efficiency and demand
20 response programs in New Mexico. As I discuss above, the apparent motivation
21 behind CCAE's proposals is to try and make their portfolios seem more economic
22 and reliable than they actually are.

23

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1 **Q. WHAT CONCERNS WERE RAISED BY CCAE REGARDING THE**
2 **MODELING USED BY PNM FOR ENERGY EFFICIENCY RESOURCES?**

3 **A.** CCAE Witness Brant claims that PNM's assumption regarding the cost of
4 demand-side management programs is inconsistent with its historical
5 performance, in that PNM has spent significantly less per MWh of energy
6 efficiency acquired through its existing program than the Company assumed in its
7 modeling. Second, CCAE Witness Brant claims that PNM used outdated
8 information to calculate the peak load reduction from energy efficiency and
9 assumed the peak load reduction from energy efficiency is equal in each year, no
10 matter the quantity of energy efficiency acquired. In response to these purported
11 errors, CCAE developed its own energy efficiency assumptions to include in the
12 EnCompass model for CCAE's portfolios.

13

14 **Q. DOES PNM AGREE WITH CCAE WITNESS BRANT'S TESTIMONY**
15 **REGARDING PNM'S PROJECTED COSTS AND SAVINGS IN ITS**
16 **ENERGY EFFICIENCY PROGRAMS?**

17 **A.** No. As I explain below in more detail, CCAE Witness Brant makes over-
18 simplifying assumptions based on a brief program history and applies those
19 assumptions over a 20-year forecast period.

20

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1 **Q. DOES PNM AGREE WITH THE ENERGY EFFICIENCY ASSUMPTIONS**
2 **THAT CCAE USED TO DEVELOP ITS OWN PORTFOLIOS?**

3 **A.** No. PNM has identified the following flaws and inaccurate assumptions in
4 CCAe Witness Brant’s testimony.

5
6 First, CCAE Witness Brant’s first-year energy savings (Table JB-2, 2019, 85,988
7 MWh) are overstated by approximately 10,000 MWh, as PNM’s assumptions
8 provided through discovery in this case show 2019 projected savings that are
9 estimated at 76,000 MWh.

10
11 Second, the actual costs of PNM’s programs have risen at an average rate of 9
12 percent per year between the years 2008 and 2018. This is significantly higher
13 than the 1.5 percent escalation rate used by CCAE Witness Brant to estimate
14 savings between 2019 and 2038.

15
16 Third, the 2016 energy savings in CCAE Witness Brant’s Table JB-1 include
17 approximately 9,304 MWh of savings from the persistence of a prior year
18 program at a cost of \$3.65/MWh, which is significantly lower than the
19 \$233/MWh presented for 2016.

20
21 Fourth, CCAE Witness Brant uses an outdated budget assumption for 2019
22 (\$21,324,000). PNM’s 2019 budget for energy efficiency programs (not
23 including demand response) is \$17,608,000. Using Witness Brant’s assumed

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1 energy efficiency cost of \$248/MWh would lower his first-year savings from
2 85,988 MWh to 69,782 MWh, which significantly lowers all future projections.

3
4 Finally, Table JB-2 underestimates future costs of the Energy Independence and
5 Security Act (“EISA”) lighting standards on residential lighting programs. The
6 costs seen in the initial program (2018 program costs were approximately \$118
7 per MWh) are expected to increase substantially in the future, while savings from
8 these programs will diminish over time with the growing saturation of energy
9 efficient lighting.

10

11 **Q. HOW DO CCAE’S ASSUMPTIONS REGARDING PNM’S PROJECTED**
12 **ENERGY EFFICIENCY COSTS AND SAVINGS IMPACT CCAE’S**
13 **MODELING RESULTS?**

14 **A.** The combined effect of CCAE’s assumptions serve to underestimate the projected
15 costs per MWh for PNM’s programs and overestimate the future energy savings
16 from energy efficiency. Applying a first-year savings cost rate that is lower than
17 what PNM has assumed results in a bias for all future calculated savings. CCAE
18 Witness Brant compounds this problem by grossly understating the annual
19 escalation rate in costs. Incorporating CCAE’s unsubstantiated peak load
20 reduction would artificially reduce the peak that PNM plans for and would
21 undermine PNM’s ability to reliably serve its customers, since the resources
22 cannot be procured quickly enough to meet customers’ needs if the savings from
23 energy efficiency are not achieved.

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1 **Q. PLEASE DESCRIBE CCAE'S CRITICISM REGARDING THE**
2 **ASSUMPTIONS THAT PNM USES FOR ITS DEMAND RESPONSE**
3 **PROGRAMS.**

4 **A.** CCAE Witness Brant generally agrees with the assumptions and methodology
5 used by PNM to model demand response resources; nevertheless, he asserts that
6 PNM made two errors regarding the modeling of PNM's current demand response
7 programs. First, Witness Brant claims that PNM could effectively double the
8 capacity value of its Power Saver program for residential customers by 2023,
9 thereby reducing the need for replacement resources. Witness Brant supports this
10 argument by citing Xcel Energy's Saver's Switch program metrics and applying
11 the same growth rate to PNM's program. Second, CCAE Witness Brant claims
12 PNM incorrectly assumed that all energy curtailed during a demand response
13 event must be consumed once the event is complete (which is known as
14 "payback").

15

16 **Q. DO YOU AGREE WITH CCAE WITNESS BRANT'S ASSUMPTION**
17 **REGARDING THE POTENTIAL EXPANSION OF PNM'S DEMAND**
18 **RESPONSE PROGRAMS?**

19 **A.** No. CCAE Witness Brant makes several flawed assumptions when comparing
20 PNM's Power Saver program and Xcel Energy's Saver's Switch program. First,
21 Witness Brant does not account for the significant socioeconomic differences
22 between Colorado and New Mexico. Using personal consumption expenditures
23 from the Bureau of Economic Analysis, Colorado ranks in the top 20 states for

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1 personal consumption expenditures while New Mexico ranks 39th. For many
2 New Mexicans, central air conditioning is considered a luxury rather than a
3 necessity given income levels and the relative economics of purchasing and
4 operating evaporative units. This contributes greatly to the degree of evaporative
5 cooling in PNM's service territory as opposed to central air conditioning.

6
7 Second, there is an important difference between PNM's Power Saver program
8 and Xcel Energy's Saver Switch program in Colorado. PNM activates the Power
9 Saver program more frequently than Xcel's Saver's Switch and on more
10 successive days. When control events occur on successive days, this can result in
11 the attrition of active customers. CCAE Witness Brant notes that PNM had
12 approximately 37,000 of its residential customers enrolled in the Power Saver
13 program in 2018. Currently however, there are a significant number (*i.e.*, 6,900)
14 of installed devices that are inactive under this program, most likely because
15 previous participants have chosen to exit the program due to the repeated
16 activations.

17
18 Third, Witness Brant cites PNM's most recent Energy Efficiency Potential Study
19 for the proposition that 41 percent of residential customers have central air
20 conditioning and are thus eligible to participate in the Power Saver program.
21 PNM believes this may be overly-optimistic, however, because the survey was
22 only sent to a very small segment of customers.

23

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1 When these factors are considered, the idea of doubling PNM's market share in
2 four years (see Brant Table JB-3) is unrealistic.

3

4 **Q. WHAT IS YOUR RESPONSE TO CCAE WITNESS BRANT'S SECOND**
5 **CONCERN?**

6 **A.** PNM's modeling ensured that the full reliability benefits of the demand response
7 modeling were realized at the time of the system peak; consequently, CCAE
8 Witness Brant's criticism regarding payback has no bearing on the overall
9 portfolio selection or reliability analysis. PNM assumed a conservative 100
10 percent payback value in its modeling for its existing demand response programs.
11 CCAЕ's payback assumption affects the difference in production costs between
12 PNM's 100 percent payback value and CCAE's 40 percent payback for PNM's
13 Power Saver program and 28 percent payback for PNM's Peak Saver program.
14 Since each PNM demand response program can operate a maximum of 100 hours
15 (or 1 percent of all hours) per year, the impact to annual production costs are
16 minimal and does not affect the capacity expansion planning results.

17

18 **Q. PLEASE RESPOND TO CCAE WITNESS COMINGS' CRITICISM THAT**
19 **PNM DID NOT RECEIVE DEMAND RESPONSE AND ENERGY**
20 **EFFICIENCY PROPOSALS IN THE RFP.**

21 **A.** As discussed by PNM Witness Nagel, the RFP did not exclude these types of
22 bids, although these resource types are not typically bid into RFP processes for
23 large-scale generation resources. Further, the Commission's existing energy

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1 efficiency review processes target these types of programs. Through its triennial
2 energy efficiency filings PNM has the ability to expand its existing programs if
3 additional program participants can be found and the associated costs can be
4 justified. Currently, PNM has also commissioned an updated energy efficiency
5 and demand response potential study that is in progress. PNM will report the
6 results of this study to the Commission in May 2020 and will utilize these results
7 in its 2020 IRP, which will both inform and serve as the bridge to the next step in
8 the energy transition.

9
10 ***C. Equivalent Forced Outage Rate for the Four Corners Power Plant***

11 **Q. CCAE WITNESS MILLIGAN AND SIERRA CLUB WITNESS GOGGIN**
12 **EACH CONTEND THAT THE EQUIVALENT FORCED OUTAGE RATE**
13 **(“EFOR”) OF 20 PERCENT FOR FOUR CORNERS IS EXCESSIVE.**
14 **WHAT IS THE COMPANY’S RESPONSE?**

15 **A.** PNM based the 20 percent EFOR for the Four Corners Power Plant on a three-
16 year average (from 2016 to 2018) for the specific plant plus an adjustment for
17 future maintenance, equipment condition and age. This EFOR was conservative,
18 as the EFORs for these units actually exceeded 20 percent during this time period.
19 If CCAE Witness Milligan had concerns that there were outliers or extreme
20 events reported in the NERC GADS data for Four Corners that had occurred
21 within the time period PNM used and analyzed when developing its EFOR inputs,
22 he could have performed his own analysis of that data. Instead, Witness Milligan

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1 recommends an EFOR of 8.9 percent that is arbitrarily based on a NERC average
2 for coal plants of similar size and technology. Substituting this generic average
3 should be rejected because this figure clearly understates the recent average
4 historical performance of the Four Corners Power Plant.

5
6 ***D. Import/Export Limits***

7 **Q. CCAE WITNESS MILLIGAN ASSERTS THAT THE MODELING**
8 **ASSUMPTION FOR IMPORT/EXPORT LIMITS SHOULD BE SET AT**
9 **300 MW DURING PEAK LOAD HOURS AS OPPOSED TO A RANGE OF**
10 **150-300 MW. WHAT IS THE COMPANY'S RESPONSE?**

11 **A.** PNM Witness Wintermantel's Rebuttal Testimony details why the Company's
12 assumption to model a range of purchases from 200 MW to 300 MW in SERVVM
13 is reasonable. He further explains why CCAE's proposal to set the import/export
14 limit at 300 MW during peak load hours is not reasonable and would be
15 irresponsible from a reliability planning perspective. In addition, PNM Witness
16 Maestas discusses the real-world operational factors that support this range of
17 purchases in his Rebuttal Testimony.

18
19 ***E. Effective Load Carrying Capabilities***

20 **Q. DO YOU AGREE WITH CCAE WITNESS SOMMER THAT PNM USED**
21 **INCORRECT EFFECTIVE LOAD CARRYING CAPABILITIES**
22 **("ELCCs") FOR WIND AND TWO-HOUR BATTERY RESOURCES?**

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1 **A.** No. PNM used ELCCs¹² of 5 percent and 9 percent for new wind and new solar
2 respectively in the 2017 IRP. The 2017 IRP was accepted by the Commission in
3 Case No. 17-00174-UT. PNM is currently performing a new ELCC study for the
4 development of its 2020 IRP. However, this study is not yet completed.

5
6 CCAIE Witness Sommer is also incorrect about the ELCC applied by PNM to
7 two-hour batteries. Typically, the first tranche of a resource type that is added to
8 the system will experience the highest ELCC. This occurred on PNM’s system
9 with solar resources, for example. But as more solar resources have been added
10 to PNM’s system, the net peak of the system has been pushed out later and later
11 into the day. Eventually, the net peak could occur after the sun sets, which would
12 lead to a zero percent ELCC for solar.

13
14 Finally, ELCC only serves to inform the EnCompass model during the capacity
15 expansion function of that model. As I discuss in my Direct Testimony, however,
16 to ensure reliability especially with increasing renewables it is important to select
17 the right type of resources both in terms of firm capacity provided as well as the
18 flexibility attributes of the resources. This is why in my Direct Testimony I
19 recommended that the Commission evaluate $LOLE_{CAP}$ and $LOLE_{FLEX}$ along with

¹² The effective load carrying capability (“ELCC”) of a resource, which is typically presented as a percentage of nameplate capacity, represents the resource’s ability to provide full capacity at all times. Dispatchable generators such as gas turbines or combined cycles have high ELCC values because they can be called upon to provide 100 percent power most of the time. By contrast, intermittent resources (non-dispatchable) such as solar photovoltaics or wind do not exhibit high ELCCs because they may not provide maximum capacity at the same time as PNM’s peak.

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1 planning reserve margin. SERVVM does not utilize ELCC as an input, as SERVVM
2 is a stochastic production costing and reliability model that calculates LOLE
3 measures. Consequently, CCAE Witness Sommer's attempt to sever the
4 functionality of the EnCompass and SERVVM models is a misguided attempt to
5 cast doubt on PNM's modeling process, which has arrived at the lowest cost and
6 most reliable portfolio presented in this docket. While both models do have
7 individual strengths and weaknesses, it has become necessary to utilize both
8 models in conjunction with each other to provide a comprehensive view of a
9 portfolio's economics and reliability.

10
11 ***F. Transmission Cost Adjustments***

12 **Q. CCAE WITNESS SOMMER CLAIMS THAT WORKPAPERS**
13 **SUPPORTING TRANSMISSION COST ASSUMPTIONS FAILED TO**
14 **REMOVE NON-RETAIL PORTIONS OF THE TRANSMISSION COSTS**
15 **FOR THE TWO SOLAR/BATTERY HYBRID PROJECTS IN THE**
16 **CENTRAL CONSOLIDATED SCHOOL DISTRICT. WHAT IS YOUR**
17 **RESPONSE?**

18 **A.** We investigated CCAE Witness Sommer's claim and determined that she is
19 correct. In Section IX below, I address the impacts of these discrepancies and
20 provide updated NPV figures for PNM Scenarios 1 and 2. As I discuss in that
21 section, the change in NPV does not alter PNM's resource selection.

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1 Furthermore, PNM has verified that the correct assumptions were included in the
2 revenue and bill impacts in its direct case.

3

4 ***G. Energy Storage Benefits***

5 **Q. IS CCAE WITNESS DESU’S ASSERTION THAT ENERGY STORAGE**
6 **BENEFITS WERE UNDERVALUED IN PNM’S ANALYSIS CORRECT**
7 **FROM A MODELING PERSPECTIVE?**

8 **A.** No, it is not. As discussed on pages 30-31 of my Direct Testimony, the original
9 EnCompass modeling resulted in a portfolio that included ten natural gas units
10 and 70 MW less of battery storage as compared to PNM’s proposed Scenario 1.
11 Based on the SERVVM modeling, however, PNM determined that there was value
12 in a certain amount of battery storage, and that the best resource portfolio should
13 include 70 MW of batteries at the Sandia and Zamora projects in lieu of 120 MW
14 of aeroderivative gas turbines. This outcome illustrates that PNM’s modeling
15 approach captured the benefits of energy storage.

16

17 ***H. LOLE_{FLEX}***

18 **Q. PLEASE RESPOND TO CCAE WITNESS MILLIGAN’S CRITIQUE OF**
19 **LOLE_{FLEX}.**

20 **A.** PNM Witness Wintermantel addresses this issue more fully in his Rebuttal
21 Testimony, but I believe Witness Milligan’s critique is unfounded based on my
22 previous job experience. In its 2018 rate case, Southern California Edison for the

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1 first time proposed splitting up the cost allocation of capacity resources between a
2 capacity metric and a flexibility metric. The underlying rationale for Southern
3 California Edison's proposal was that the Company's loss of load probability
4 studies indicated that a significant percentage of anticipated shortfall events were
5 associated with flexibility (*i.e.*, a large amount of renewable penetration) as
6 opposed to capacity. The outcome of that rate case led to a statewide workshop
7 facilitated by the California Public Utilities Commission, where all three investor-
8 owned utilities, CAISO, and associated intervenors convened to explore the
9 proper way to evaluate flexibility from a cost allocation perspective. Although
10 any final conclusions from this workshop process have not been publicly
11 announced, the fact that utilities are recognizing significant loss of load
12 probabilities associated with ramping (*i.e.* flex) events, to the point that the
13 California Public Utilities Commission created a statewide workshop
14 demonstrates the need to fully understand flex-related reliability events with
15 increasing renewable penetration.

IV. RESPONSE TO CCAE/SJCA/DINÉ CARE

18 **Q. PLEASE SUMMARIZE CCAE, SJCA, AND DINÉ CARE'S**
19 **CONCLUSIONS AND RECOMMENDATIONS CONTAINED IN THE**
20 **DIRECT TESTIMONY OF THEIR WITNESS JASON SCHWARTZ.**

21 **A.** Witness Schwartz urges the Commission to account for global environmental
22 externalities by monetizing and incorporating a Social Cost of Carbon when

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1 evaluating resource alternatives. Witness Schwartz recommends that the Social
2 Cost of Carbon should be based on the federal Interagency Working Group's
3 estimates. Witness Schwartz believes that by doing so, PNM Scenario 3 and
4 PNM Scenario 4 (or a similar portfolio that contains no new fossil fuel-fired
5 generation) will generate hundreds of millions of dollars of global benefits above
6 and beyond PNM Scenario 1. Witness Schwartz also responds to my Rebuttal
7 Testimony in Case No. 19-00018-UT on this topic.

8

9 **Q. DO YOU AGREE WITH WITNESS SCHWARTZ'S**
10 **RECOMMENDATION THAT A SOCIAL COST OF CARBON SHOULD**
11 **BE INCORPORATED INTO THE COMMISSION'S ANALYSIS IN THIS**
12 **DOCKET?**

13 **A.** I do not. This proposal is redundant and unnecessary because the Energy
14 Transition Act achieves a zero-carbon outcome through direct legislative mandate
15 and includes interim carbon emission milestones that must be met along the way.
16 Furthermore, the inclusion of external costs is contradictory to the existing
17 planning requirements and the associated cost metrics that the Commission
18 requires PNM to use when comparing portfolios.

19

20 **Q. PLEASE EXPLAIN WHY YOU BELIEVE INCORPORATING A SOCIAL**
21 **COST OF CARBON IS UNNECESSARY IN THIS DOCKET.**

22 **A.** There are a few reasons. First, PNM certainly agrees with Witness Schwartz that
23 2045 is a minimum goal for carbon-free emissions under the Energy Transition

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1 Act. As I discuss above, PNM has already committed to moving faster and
2 eliminating carbon emissions from its resource mix by 2040. As such, the
3 Company is already working toward the ultimate outcome that advocates of a
4 Social Cost of Carbon seek. The proactive steps being taken by PNM obviates
5 the need to make predictive judgments about the Social Cost of Carbon over the
6 coming decades and, indeed, centuries. Given the legislative mandate for a zero-
7 carbon portfolio prescribed by the Energy Transition Act, as well as the increase
8 in RPS for New Mexico, the consideration of a Social Cost of Carbon becomes
9 redundant for PNM. In fact, the Energy Transition Act essentially renders the use
10 of a Social Cost of Carbon excessive for PNM’s planning practice and might even
11 render CO₂ pricing in general unwarranted (unless an actual CO₂ tax is levied)
12 because it is the regulatory requirement to reduce carbon emissions, not CO₂
13 pricing, that drives planning decisions. Incorporating a Social Cost of Carbon
14 would have been an alternative mechanism to the approach adopted by the Energy
15 Transition Act to advance carbon-free energy in New Mexico.

16
17 Second, contrary to the arguments advanced by Witness Schwartz in his Direct
18 Testimony, requiring PNM to move even faster now would be inconsistent with
19 the glide path to carbon-free energy that is set forth in the Energy Transition Act.
20 The Act states that “[r]easonable and consistent progress shall be made over time”
21 toward achieving the zero-carbon requirement in 2045.¹³ To facilitate this

¹³ N.M. Stat. Ann. § 62-16-4(A)(6).

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1 transition, the Act imposes stringent CO₂ caps on a qualifying utility’s portfolio.
2 This cap declines from four hundred pounds of CO₂ per MWh in 2023 to two
3 hundred pounds of CO₂ per MWh in 2032 and every year thereafter.¹⁴ Moreover,
4 while the Act calls for consideration of “the economic and environmental costs
5 and benefits of renewable energy resources and zero carbon resources” at the tail
6 end of the energy transition in 2040 and 2045, the Commission is simultaneously
7 required to maintain the reliable operation of the electric system while preventing
8 unreasonable impacts to customers’ bills.¹⁵ Accordingly, the Act does not
9 mandate that resources with higher environmental attributes should outweigh
10 reliability and cost considerations, especially during the first stage of the
11 transition. Witness Schwartz’s proposal for a Social Cost of Carbon would
12 effectively put a thumb on the scale and result in a flash cut of replacement
13 resources that would disregard these reliability and cost considerations.

14
15 Third, in Case No. 06-0044-UT the Commission mandated the use of
16 standardized prices for carbon emissions for use in IRPs beginning in 2010, based
17 on workshops addressing relevant factors, such as, the risk of future regulation,
18 trading prices for carbon allowances in established national and international
19 markets, and state policies regarding greenhouse gas reduction.¹⁶ PNM complied
20 with the Commission-mandated methods for consideration of carbon costs in its

¹⁴ See *id.* § 62-18-10(D).

¹⁵ *Id.* § 62-16-4(B).

¹⁶ Case No. 06-00448-UT, *Final Order* (NMPRC June 19, 2017).

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1 analyses in this case, and these methods do not include a Social Cost of Carbon.
2 While Witness Schwartz responds to my Rebuttal Testimony in Case No. 19-
3 00018-UT by arguing that the Commission’s IRP requirements could be
4 reinterpreted to require use of a Social Cost of Carbon, it seems to me that it
5 would not be appropriate to depart from established Commission standards in this
6 docket and fold in a new and vastly different method for considering carbon costs
7 that could impact all utilities in the state.

8
9 Furthermore, 17.7.3.7(J) NMAC requires portfolio costs to be compared using the
10 NPV of revenue requirements proposed by utilities to meet electric system
11 demand during the planning period, consistent with reliability and risk
12 considerations. While Witness Schwartz claims that the Social Cost of Carbon
13 “will not show up as an adder on customers’ bills or change the costs to customers
14 that are already calculated for the various scenarios,”¹⁷ utility revenue
15 requirements directly influence utility rates and ultimately customer bills.
16 Combining costs that are external to the utility system to what is passed on from
17 the utility to its customers will impact the portfolio economics and the resulting
18 costs associated with a more expensive portfolio will be passed through to PNM’s
19 customers. Given the legislative mandate incorporated into the Energy Transition
20 Act to achieve a zero-carbon portfolio, there is no reason to add this complexity to
21 the process.

¹⁷ Schwartz Direct Testimony at 15:8-9.

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1 Finally, to the extent CCAE, SJCA, Diné CARE, or others want PNM to move
2 even faster on carbon emission reductions, on a going-forward basis the state’s
3 Renewable Energy Act authorizes the Commission, in response to an application
4 or motion, to initiate a separate process to consider “financial or other incentives
5 to encourage public utilities to produce or acquire” resources that would result in
6 accelerated compliance with RPS requirements and the zero-carbon
7 requirement.¹⁸

V. RESPONSE TO SIERRA CLUB

10 **Q. HOW DOES THE COMPANY RESPOND TO SIERRA CLUB WITNESS**
11 **GOGGIN’S ASSERTION THAT ASSUMPTIONS REGARDING**
12 **RENEWABLE OUTPUT PATTERNS BIASED THE COMPANY’S**
13 **ANALYSIS AGAINST RENEWABLES?**

14 **A.** This is not correct. As PNM Witness Wintermantel explains in his Rebuttal
15 Testimony, SERVM captures renewable output patterns dependent on weather
16 variations based on NREL’s solar irradiance database as well as historical wind
17 data.

18
19 **Q. DOES THE COMPANY AGREE WITH SIERRA CLUB WITNESS**
20 **GOGGIN’S ASSUMPTION THAT AN ADDITIONAL 35 MW OF**
21 **DEMAND RESPONSE IS ATTAINABLE?**

¹⁸ See NMSA 1978, § 62-16-4(D).

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1 **A.** No. As an initial matter, Sierra Club Witness Goggin relies on FERC’s “2018
2 Assessment of Demand Response and Advanced Metering” report to support his
3 contention that PNM demand response programs lag behind other utilities as a
4 percentage of peak load. Although PNM is not specifically referenced in this
5 report, there are references to WECC (of which PNM is a member). To infer
6 PNM-specific potential from WECC – which is geographically the largest and
7 most diverse of the eight regional entities with delegated authority from NERC
8 and FERC – would be unreasonable. Moreover, Figure 3-1 of the FERC report
9 actually indicates a year-over-year decline in Potential Peak Savings (MW) from
10 retail demand response programs from 2014 through 2016 for the WECC region.
11
12 Sierra Club Witness Goggin also states on page 34 of his Direct Testimony that
13 Sierra Club “conservatively assumed that additional demand response could be
14 obtained at a 10 percent premium to the all-in cost for PNM’s current demand
15 response programs.” PNM’s Energy Efficiency and Demand Response programs
16 are evaluated by an independent evaluator every year. In its 2018 report, the
17 independent evaluator concluded that PNM’s two demand response programs
18 (*i.e.*, Power Saver and Peak Saver) are not cost-effective.¹⁹ Therefore, Sierra
19 Club Witness Goggin’s assumption that additional cost-effective resources can be
20 obtained at a small premium over current program costs is unreasonable.

¹⁹ See Evergreen Economics, *Evaluation of the 2018 Public Service Company of New Mexico Energy Efficiency and Demand Response Programs*, Final Report, at 8 (Apr. 5, 2019), available at <https://www.pnm.com/regulatory> (“[i]n terms of cost effectiveness, the UCT test was used and found all PNM programs except Power Saver and Peak Saver to be cost effective.”).

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1 **Q. SIERRA CLUB WITNESS GOGGIN ARGUES THAT THE 200-300 MW**
2 **CAP ON MARKET PURCHASES IS TOO LOW. WHAT IS YOUR**
3 **RESPONSE?**

4 **A.** PNM's modeling of 200-300 MW of market purchases is in line with historic data
5 and is greater than what the Company's traders are actually experiencing. This is
6 discussed in detail by PNM Witnesses Maestas and Wintermantel.

7

8 **Q. PLEASE COMMENT ON SIERRA CLUB WITNESS GOGGIN'S**
9 **CRITIQUE THAT PNM HAS NOT ACCOUNTED FOR CORRELATED**
10 **OUTAGES OF GAS GENERATORS IN ITS ANALYSIS.**

11 **A.** Sierra Club Witness Goggin's critique is misguided. PNM has analyzed Witness
12 Goggin's workpapers and he has mischaracterized the majority of the outages
13 identified in his Direct Testimony as correlated or common mode. The majority
14 of the events Witness Goggin identified were correlated only by the date on which
15 they occurred, and not by the underlying cause of failure. In other words, these
16 were independent outages that happened to occur at the same time. These types
17 of events are already accounted for in PNM's modeling, and only 25 hours or 0.03
18 percent of the outages over the past eight years appear to be true common failures.

19

20 With respect to the 2011 Permian Basin event discussed by Witness Goggin, the
21 NMPRC conducted an investigation in Case No. 11-00039-UT and determined
22 that PNM and the other investor-owned utilities in the state did not significantly

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1 contribute to the supply interruption event.²⁰ Regardless, in response to the 2011
2 event PNM took a number of steps to help assure the reliable operation of its
3 generation fleet in cold weather. This included updating the Company's Winter
4 Weather Readiness Program and undertaking weather hardening modifications so
5 that the Company's generation facilities can better withstand and operate under
6 extreme cold conditions. Moreover, PNM entered into firm natural gas delivery
7 contracts with both Transwestern Pipeline Company and El Paso Natural Gas
8 Company. These agreements provide for redundant transmission capabilities that
9 can supply gas from either the San Juan Basin in northwestern New Mexico or the
10 Permian Basin in southeastern New Mexico, thereby providing multiple source
11 and multiple transmission options. Finally, as PNM Witness Fallgren discussed
12 in his Direct Testimony, Pinon Gas Plant will be served by a new source of gas
13 delivered through the interstate pipeline owned and operated by El Paso Natural
14 Gas Company. The addition of this new resource provides greater geographical
15 diversity for the overall generation portfolio because it provides a greater
16 diversity of access to natural gas supply sources.

17
18 **Q. DO YOU AGREE WITH SIERRA CLUB WITNESS GOGGIN'S CLAIM,**
19 **AT PAGES 49-52 OF HIS TESTIMONY, THAT LIMITATIONS ON THE**
20 **SIZE AND CAPACITY OF BATTERY PROJECTS FORCED PNM TO**
21 **CHOOSE SUBOPTIMAL RESOURCE PORTFOLIOS?**

²⁰ Case No. 11-00039-UT, Final Order, ¶¶ 37-39 (Dec. 13, 2012).

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1 **A.** No. PNM Scenario 1 is the optimal portfolio given the reliability requirements
2 and technological risk associated with the early adoption of battery storage. PNM
3 acknowledged in its direct case that there were lower-cost portfolios in its
4 unconstrained modeling,²¹ but that these portfolios would be too risky for PNM’s
5 customers. PNM Witnesses Fallgren and Kemp discuss this issue further and
6 explain why PNM’s proposed battery procurement is aggressive for a utility of its
7 size. PNM Witness Dorris also discusses the expected decline in battery storage
8 costs.

9
10 When considering resource optimization from a planning perspective, there is an
11 optimal solution to a particular problem given a set of input assumptions and
12 constraints. PNM’s preliminary portfolio modeling and RFP evaluation identified
13 that the optimal level of battery deployment for PNM’s system was between 150
14 MW and 170 MW of battery storage. This consisted of one large 150 MW battery
15 and potentially another smaller 20 MW battery that were both paired with solar
16 projects for investment tax credit (“ITC”) purposes. The solar battery pairing led
17 to a reduction in cost but also restricted the use of the battery. As discussed by
18 PNM Witness Fallgren on pages 21 to 24 of his Direct Testimony and as further
19 addressed by PNM Witness Kemp in his Rebuttal Testimony, PNM identified
20 that, based on the size of PNM’s system and the Company’s lack of experience
21 with batteries, the initial battery deployment should not exceed a maximum

²¹ See PNM Exhibit NW-2.

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1 project size of 40 MW. The results of PNM’s refined portfolio modeling that
2 incorporated the 40 MW cap resulted in an optimal level of battery deployment
3 for PNM’s system that was between 100 MW and 130 MW of battery storage, an
4 amount of initial battery storage deployment that was very much aligned with the
5 initial portfolio modeling. The change in the portfolio composition is that the
6 single 150 MW battery was eliminated and three smaller batteries were added.
7 This resulted in a final energy storage portion of the portfolio consisting of four
8 batteries – two that were paired with solar for ITC purposes and two stand-alone
9 batteries that could be operated more flexibly. The 130 MW level of deployment
10 represents approximately 5 percent of PNM’s Balancing Area Authority overall
11 estimated peak load in 2022. As a measure of PNM’s retail load, this value would
12 be closer to 6.4 percent.

13
14 Finally, I would emphasize that the Pinon Gas Plant is always a necessary
15 component of the “unconstrained” battery portfolios. As shown in the Direct
16 Testimony of PNM Witness Wintermatel in PNM Exhibit NW-2, the Tier 1 and
17 Tier 2 portfolios that did not include any battery limitations were comprised of the
18 seven-unit Pinon Gas Plant, 350 MW of Solar PPAs, and between 150 MW and
19 170 MW of battery resources.²² PNM Scenario 1 still includes the seven-unit
20 Pinon Gas Plant and 350 MW of Solar PPAs, but rather than 150 to 170 MW of

²² Similarly, PNM’s EnCompass modeling of the Tier 1 and Tier 2 resources resulted in 350 MW of solar, 150 MW of battery storage (a single battery) and 320 MW of aeroderivative gas turbines.

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1 battery storage (comprised of one or two batteries), it contains 130 MW of battery
2 storage (comprised of four batteries).

3
4 **VI. RESPONSE TO SWG**

5 **Q. WHAT IS YOUR RESPONSE TO SWG WITNESS BABCOCK'S**
6 **CONTENTION THAT PNM'S RESOURCE PLANNING PROCESS**
7 **MIGHT COMPROMISE THE COMPANY'S ABILITY TO MEET ITS**
8 **ZERO-CARBON GOAL IN 2040?**

9 **A.** I disagree with SWG Witness Babcock. PNM's resource replacement plan for
10 this application is consistent with the 2017 IRP and we have applied the same
11 modeling approach that was used during that process. PNM's resource planning
12 process will allow the Company to harness the evolution of battery storage
13 technology while ensuring that PNM mitigates technology risks for our
14 customers. As discussed by PNM Witnesses Fallgren and Nagel, PNM's resource
15 selection process was inclusive, comprehensive and rigorous. PNM evaluated
16 thousands of different portfolio combinations to arrive at the optimal resource mix
17 presented in this case as PNM Scenario 1. As I have previously discussed, the
18 Pinon Gas Plant is part of that optimal resource mix because it will play a critical
19 role for back-up capacity during unforeseen weather events and as PNM Witness
20 Dorris discusses, could be used as a zero-carbon resource in the future.

21

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1 **Q. SWG WITNESS BABCOCK CONTENDS THAT PNM'S PLANNING**
2 **PROCESS DID NOT FULLY CONSIDER THE OPPORTUNITIES AND**
3 **CONSEQUENCES OF JOINING THE ENERGY IMBALANCE MARKET**
4 **("EIM") IN 2021. WHAT IS YOUR RESPONSE?**

5 **A.** As an initial matter, full consideration of the EIM comes with experience through
6 participation over time. That said, PNM did include an assessment of EIM in its
7 analysis. The EIM was modeled in PowerSimm, as discussed by PNM Witness
8 Dorris, and the intra-hour benefits were captured within the PowerSimm
9 modeling. This is reflected in my Direct Testimony in PNM Table NLP-2. The
10 PowerSimm analysis demonstrated that PNM Scenario 1 had economic
11 advantages over the other modeled scenarios when including the EIM. As more
12 fully explained by PNM Witness Dorris, the PowerSimm analysis demonstrated
13 that the more flexible the portfolio, the more benefits can be gained through
14 participation. However, these benefits must be balanced against any capital
15 investment necessary to achieve that flexibility. The added flexibility benefits
16 afforded in PNM's Scenario 1 more appropriately balance the capital costs against
17 EIM benefits.

18

19 **Q. DO YOU AGREE WITH SWG WITNESS BABCOCK THAT PNM'S**
20 **ANALYSIS FAILED TO RECOGNIZE HOW THE ENERGY**
21 **TRANSITION ACT CHANGED THE COMPANY'S RESOURCE**
22 **REQUIREMENTS AND THE TIMING OF NEW RESOURCE BUILDS?**

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1 **A.** No. To the contrary, PNM’s 2017 IRP considered a high-renewable sensitivity
2 case, and the SERVVM modeling that backed that analysis included a number of
3 high-renewable sensitivities in terms of reliability. The outcome of that high-
4 renewable sensitivity case was consistent with the resource portfolio that PNM
5 ultimately selected after going back and modeling the specific requirements of the
6 Energy Transition Act. The 2017 IRP also considered battery storage
7 introduction based on pricing obtained in the RFP process. The RFP was also
8 broad enough and allowed for a diversity of resource bids, consistent with the
9 subsequently-enacted Energy Transition Act. Therefore, SWG Witness
10 Babcock’s assertion that the PNM did not recognize that the Energy Transition
11 Act changed PNM’s resource requirements and timing of resources is incorrect.

12

13 **Q.** **SWG WITNESS BABCOCK STATES THAT TRADITIONAL PLANNING**
14 **MODELS DO NOT REPORT THE COMPREHENSIVE RANGE OF**
15 **POWER QUALITY ISSUES AND THEREFORE DO NOT SUPPORT**
16 **PNM’S RESPONSIBILITY TO MAINTAIN VOLTAGE AND**
17 **FREQUENCY ON THE SYSTEM. DOES THIS MEAN THE MODELS**
18 **ARE DEFICIENT?**

19 **A.** No, it does not. Capacity expansion and production costing models such as
20 EnCompass, SERVVM and PowerSimm are not designed to analyze reactive power
21 flow or voltage support. I am unaware of any economic planning model that
22 incorporates these capabilities. Assessments of reactive power and voltage
23 support needs are performed by transmission (not resource planning) departments

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1 and are covered in the studies required to interconnect the facilities to the
2 transmission system. Indeed, when SWG Witness Babcock was questioned in
3 discovery he confirmed that he was “not aware of any utilities that have
4 performed the kind of reliability modeling and/or analysis addressed at pages 25-
5 27 of his Direct Testimony in the specific context of a commission docket
6 addressing a utility's proposals to acquire resources.”²³ PNM Witness Duane
7 discusses the studies that PNM has already performed related to the Pinon Gas
8 Plant and ongoing studies associated with the other PNM Scenario 1 resources.

9
10 **Q. SWG WITNESS BABCOCK CRITICIZES PNM FOR DEVELOPING ITS**
11 **PROPOSED REPLACEMENT PORTFOLIO OUTSIDE OF A**
12 **COMPREHENSIVE INTEGRATED RESOURCE PLANNING PROCESS.**
13 **PLEASE EXPLAIN HOW PNM’S INTEGRATED RESOURCE**
14 **PLANNING PROCESS AND SUBSEQUENT CERTIFICATE OF**
15 **CONVENIENCE AND NECESSITY FILINGS WORK.**

16 **A.** Unlike other jurisdictions in our region such as Colorado or Nevada, accepted
17 IRPs in New Mexico do not constitute Commission approval that allows a utility
18 to pursue projects within its respective action plan. When a resource need is
19 identified in PNM’s IRP, PNM follows the steps laid out in the corresponding
20 action plan to acquire a resource. After conducting an RFP, PNM must also make
21 a separate CCN filing to demonstrate that the proposed resource is in the public

²³ SWG Response to Sierra Club Interrogatory 1-5

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1 interest. This does not require another IRP, as the IRP has already laid the
2 foundation and set forth an action plan regarding PNM's resource need. Before
3 submitting a CCN application, PNM updates and refines the base case IRP
4 assumptions to reflect the most current and likely future conditions when
5 analyzing RFP bids. In this way, the IRP informs the RFP process and ultimate
6 CCN filing even though PNM does not replicate the IRP process.

7
8 **Q. HOW DID PNM'S 2017 IRP RESULT IN THE PORTFOLIO PROPOSED**
9 **IN THIS FILING?**

10 **A.** PNM followed the same process I just described. The 2017 IRP identified that
11 PNM's customers would likely experience an economic benefit if the San Juan
12 coal plant were to be shut down in June of 2022 and replaced with a resource
13 portfolio that includes natural gas resources, renewable resources, and potentially
14 battery storage. As discussed in my Direct Testimony, the action plan for the
15 2017 IRP required PNM (among other things) to solicit an all-source RFP for
16 replacement resources. The action plan also required other measures to move
17 forward with the abandonment of the San Juan coal plant. As discussed by PNM
18 Witnesses Fallgren and Nagel, PNM issued the all-source RFP in October 2017
19 and a supplemental Storage RFP in April 2019. Between May 2018 and June
20 2019 PNM evaluated the bids received in response to the RFPs to determine the
21 composition of the proposed replacement portfolio.

22

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1 **Q. PLEASE RESPOND TO SWG WITNESS BABCOCK’S ASSERTION**
2 **REGARDING THE COMPANY’S ASSESSMENT OF THE REEVES**
3 **GENERATING STATION.**

4 **A.** In PNM’s Four-Year Action Plan in its 2017 IRP, the Company stated that it
5 would “complete an economic assessment of the Reeves Generating Station to
6 develop a plan for Reeves that coordinates with the need for replacement
7 resources, assuming PNM retires SJGS in 2022.”²⁴ SWG Witness Babcock’s
8 suggestion that the planned economic assessment was not completed or that the
9 plan for Reeves has not been coordinated with PNM’s development of a resource
10 replacement portfolio is incorrect. The specific action plan as identified for the
11 Reeves station in the 2017 IRP called on PNM to “assess [the station’s] reliability
12 requirements and long-term investment strategy.”²⁵ This action was completed in
13 in 2017 and Reeves will be further evaluated as part of the ongoing 2020 IRP
14 process.

15

16 **VII. RESPONSE TO WESTMORELAND**

17 **Q. WHAT IS THE PURPOSE OF THIS SECTION OF YOUR TESTIMONY?**

18 **A.** Westmoreland Witness Griffey offers reasons as to why a hypothetical PPA that
19 could be offered by Enchant Energy will be more competitive than the analyses of

²⁴ PNM 2017-2036 Integrated Resource Plan, at 4.

²⁵ *Id.* at 149.

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1 San Juan Generating Station with CCUS offered by PNM in Case No. 19-00018-
2 UT. I respond to several of his contentions.

3

4 **Q. WESTMORELAND WITNESS GRIFFEY ARGUES THAT THE**
5 **BRATTLE GROUP'S ANALYSIS IN CASE NO. 19-00018-UT SHOULD**
6 **HAVE INCLUDED RENEWABLE BIDS AND/OR SYSTEM ENERGY**
7 **INSTEAD OF A SIMPLE CYCLE GAS TURBINE TO MAKE UP FOR**
8 **THE CAPACITY CONSUMED BY THE CCUS. WHAT IS YOUR**
9 **RESPONSE?**

10 **A.** Witness Griffey appears to misapprehend the Brattle Group's analysis in Case No.
11 19-00018-UT. The Brattle Group's analysis did allow for market purchases and
12 system energy to serve the requirements of the CCUS load. The capacity
13 requirements were fulfilled by aeroderivative turbines that were based on pricing
14 the Pinon Gas Plant. By contrast, PNM's EnCompass-based analysis selected
15 battery storage as the replacement capacity for the CCUS. This alternative was
16 actually more costly than the aeroderivatives assumed by the Brattle Group.

17

18 **Q. WITNESS GRIFFEY CLAIMS THAT "PNM ONLY DISPATCHED SJGS**
19 **WITH CCUS AGAINST ITS NATIVE RETAIL LOAD, RATHER THAN**
20 **MODELING SALES AND PURCHASES FROM THE WESTERN**
21 **INTERCONNECT AS IT DID IN ITS DETAILED ANALYSIS OF OTHER**
22 **ALTERNATIVES." WHAT IS YOUR RESPONSE?**

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1 **A.** To maintain prudent planning practices when modeling, PNM does not include a
2 wholesale market when it conducts its capacity expansion analysis. Prudent
3 planning for a regulated utility does not justify investments based on non-firm
4 wholesale sales. PNM justifies investments in new resources based on serving
5 native retail load. However, PNM tests candidate resource portfolios in SERVM
6 for reliability and includes market purchases and sales in this analysis to
7 determine the costs and benefits of each portfolio in a five-minute resolution
8 production cost simulation. Using this technique, PNM can properly plan for new
9 resources to serve its customers and further refine its analysis using a more
10 detailed simulation that examines reliability and potential market purchases and
11 sales. PNM will analyze portfolios to ensure PNM can take advantage of any
12 market conditions only after a portfolio has been selected.

13

14 **Q.** **WITNESS GRIFFEY CLAIMS THAT “PNM DOES NOT APPEAR TO**
15 **HAVE INCLUDED THE 45Q TAX CREDITS FOR CO₂ PRODUCTION AS**
16 **PART OF DISPATCH COST, WHICH DEPRESSES SJGS’S CAPACITY**
17 **FACTOR AND THE AMOUNT OF TAX CREDITS.” WHAT IS YOUR**
18 **RESPONSE?**

19 **A.** I disagree with Westmoreland Witness Griffey. As noted in my Rebuttal
20 Testimony in Case No. 19-00018-UT, PNM specifically modeled the 45Q tax
21 credits for CO₂ production as part of dispatch costs for San Juan coal plant. The
22 45Q tax credits were grossed up by marginal income taxes. As a result, the

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1 capacity factor of the San Juan coal plant increased by almost 20 percent above
2 the capacity factor in PNM's original San Juan continues case.

3
4 **Q. WITNESS GRIFFEY CLAIMS THAT "PNM OPERATED SJGS UNTIL**
5 **2039 RATHER THAN CEASING OPERATION WHEN THE TAX**
6 **CREDITS EXPIRE, I.E., IN OR ABOUT 2034. THIS MAKES THE CCUS**
7 **OPTION LOOK LIKE IT IS A MORE EXPENSIVE OPTION THAN IT**
8 **IS." HE FURTHER STATES THAT "THE TERM OF A PPA WOULD BE**
9 **COINCIDENT WITH THE TERM OF THE SECTION 45Q TAX**
10 **CREDITS AND SHOULD BE EVALUATED AS SUCH." WHAT IS YOUR**
11 **RESPONSE?**

12 **A.** It is true that PNM did not evaluate a PPA in our analysis in Case No. 19-00018-
13 UT because a PPA utilizing CCUS was not bid into the RFP. Therefore, the
14 potential terms of any such PPA are speculative. In any event, PNM did evaluate
15 the investment in San Juan and the corresponding recovery of those costs over the
16 20-year planning period. Based on PNM's goal to be carbon-free by 2040, in
17 Case No. 19-00018-UT PNM evaluated the San Juan coal plant with CCUS
18 through 2039 and assumed recovery of the capital investments on a depreciation
19 schedule associated with this end-of-life year. I note that if the depreciation
20 schedule was changed to match the term of the Section 45Q tax credits, that cost-
21 recovery of PNM's share of the investment in San Juan with CCUS would occur
22 over a shorter period of time, thereby increasing the annual revenue requirements
23 and in turn customer rates. This assumption would also require additional

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1 replacement capacity to be procured in 2035 that would increase the overall cost
2 of the portfolio.

3
4 **Q. WITNESS GRIFFEY CRITICIZES THE HEAT RATE OF THE LM 6000S**
5 **INCLUDED IN PNM SCENARIO 1 AND SUGGESTS THAT THESE**
6 **UNITS WILL EMIT MORE CARBON PER MWH THAN THE SAN JUAN**
7 **COAL RETROFITTED WITH CCUS. WHAT IS YOUR RESPONSE?**

8 **A.** Witness Griffey's criticism is misguided. The proposed LM 6000s at Pinon Gas
9 Plant will operate only as needed and are being proposed due to the flexible and
10 reliable capacity they will provide.²⁶ These gas turbines will aid the integration of
11 additional renewables required by the Energy Transition Act and will serve as
12 reliable back-up capacity for years to come. The same cannot be said for San
13 Juan with CCUS. The San Juan coal plant is not capable of providing the flexible
14 services that Pinon Gas Plant will, and it is likely that San Juan's reliability and
15 flexibility will be further reduced after a CCUS retrofit.

16
17 **VIII. RESPONSE TO STAFF**

18 **Q. HOW DO YOU RESPOND TO STAFF'S RECOMMENDATION THAT**
19 **PNM BE REQUIRED TO AMEND ITS APPLICATION AND SUBMIT AN**

²⁶ SWG Witness Griffey's reference to the emission rate of an LM 6000 misses the bigger picture. The environmental impacts of PNM Scenario 1 should be assessed on a portfolio basis as opposed to individual technology type. This is why the Energy Transition Act sets forth requirements for carbon emissions on average for each unit of retail energy served.

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1 **ANALYSIS OF A CCUS RETROFIT AT SAN JUAN THAT INCLUDES**
2 **45Q TAX CREDITS AND THE SALE OF CO₂ FOR ENHANCED OIL**
3 **RECOVERY?**

4 **A.** Contrary to Staff's assertion, PNM has not ignored CCUS technology in its
5 analysis. As I discussed in my Rebuttal Testimony in Case No. 19-00018-UT, in
6 2010 PNM commissioned a study of CCUS retrofit on the four operating units at
7 the San Juan coal plant. The 2010 study showed that a retrofit of CCUS was both
8 risky and cost-prohibitive. Moreover, requiring an amended application is
9 unnecessary because PNM has already performed and submitted an analysis of a
10 CCUS retrofit at the San Juan coal plant for the Commission's consideration in
11 Case No. 19-00018-UT.

12
13 **Q.** **PLEASE SUMMARIZE THE RESULTS OF THE COMPANY'S**
14 **ANALYSIS.**

15 **A.** As I discussed in my Rebuttal Testimony in Case No. 19-00018-UT, the
16 Company's analysis demonstrated that under the most optimistic assumptions a
17 CCUS retrofit was \$343 more expensive than PNM Scenario 1 on an NPV basis.²⁷
18 However, under assumptions that are more comparable to recently completed
19 CCUS projects, the cost increase relative to PNM Scenario 1 could be \$1.3 billion
20 or more.²⁸

²⁷ See Rebuttal Testimony of PNM Witness Phillips, Case No 19-00018-UT, PNM Table NLP-1.

²⁸ *Id.*

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

- 9 • SJGS CCUS 1 uses the assumptions based on the S&L 2019 study as
10 summarized in PNM Exhibit NLP-1 (Rebuttal).
- 11 • SJGS CCUS 2 is the same as SJGS CCUS 1 except a \$12/tonne EOR
12 price is used.
- 13 • SJGS CCUS 3 is the same as SJGS CCUS 2 with the capital cost
14 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

16 Furthermore, this analysis is conservative as it is possible that additional
17 environmental expenditures would need to be made to add selective catalytic

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1 reduction (“SCR”) to the San Juan coal plant in order to comply with the second
2 planning period of the U.S. Environmental Protection Agency’s Regional Haze
3 Rule, as discussed in the Rebuttal Testimony of PNM Witness Fallgren in Docket
4 19-00018-UT.

5

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

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

15

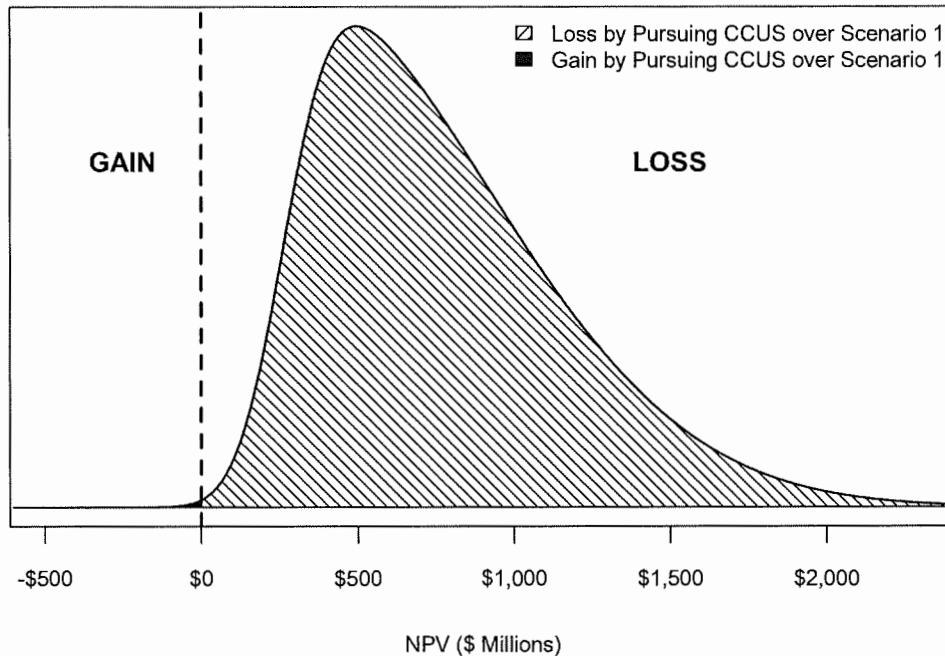
16

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1

PNM Figure NLP-1 (Rebuttal)

Loss Distribution CCUS vs Scenario 1



2

3 Every \$1/tonne assumed for EOR prices is equivalent to almost \$21 million NPV
4 which presents a large risk to customers if that price does not materialize.
5 Similarly, assumed capital cost for the CCUS retrofit presents a risk of about \$40
6 million NPV for each \$100/kW increase in capital costs. Using this information,
7 the risk profile can be extrapolated using an EOR price range of \$0/tonnes to
8 \$40/tonnes,²⁹ a capital cost range of \$2,155/kW from the 2019 CCUS Study to
9 \$5,800/kW based on the actual capital costs of the CCUS retrofits at Boundary

²⁹ See Case No 19-00018-UT, Direct Testimony of Staff Witness Solomon at n.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.

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1 Dam and Petra Nova. This range of sensitivities reinforces the figure above
2 resulting in 120 of 123 cases where PNM Scenario 1 outperforms the CCUS
3 retrofit alternative, by over \$1 billion on average and as much as \$2 billion under
4 certain assumptions.

5

6 **Q. HAS STAFF REQUESTED MODELING RUNS RELATED TO A CCUS**
7 **RETROFIT OF THE SAN JUAN COAL PLANT TO SUPPORT ITS**
8 **POSITION?**

9 **A.** No, Staff has not made any such modeling requests.

10

11 **Q. WHAT IS STAFF'S RECOMMENDATION IF PNM IS NOT REQUIRED**
12 **TO AMEND ITS APPLICATION TO INCLUDE THE SAN JUAN COAL**
13 **PLANT CCUS RETROFIT ANALYSIS AS ITS BASE CASE?**

14 **A.** Staff Witness Eschberger states that the NPV difference between PNM Scenario 1
15 and 2 is \$43 million or 0.9 percent³⁰ and concludes that this difference is not
16 statistically significant. Based on its analysis, Staff also concludes that PNM
17 Scenarios 1 and 2 are very close in terms of customer bill and environmental
18 impacts. As a result, Staff prefers PNM Scenario 2 based on its view that this
19 resource portfolio would maximize service reliability and minimize the economic
20 impacts to San Juan County.

21

³⁰ Staff Witness Eschberger's percent difference calculation suffers from the same deficiency I discussed earlier with respect to CCAE Witness Sommer.

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1 **Q. DO YOU AGREE WITH STAFF THE NPV DIFFERENCES BETWEEN**
2 **PNM SCENARIOS 1 AND 2 ARE NOT STATISTICALLY SIGNIFICANT?**

3 **A.** No, quite the opposite. PNM addressed this very question in response to the
4 Commission's October 7, 2019 Bench Request Order. In our response the
5 Company demonstrated the statistical significance of the NPV cost differences
6 between PNM Scenarios 1, 2 and 3 at a confidence level exceeding 99 percent.

7

8 **Q. DOES PNM SUPPORT STAFF'S RECOMMENDATION TO PURSUE**
9 **PNM SCENARIO 2?**

10 **A.** No. For the reasons discussed by PNM Witness Fallgren in his Rebuttal
11 Testimony, the Company recommends PNM Scenario 1.

12

13 **IX. UPDATED NPV ANALYSES**

14 **Q. WHAT IS THE PURPOSE OF THIS SECTION OF YOUR TESTIMONY?**

15 **A.** The purpose of this section of my Rebuttal Testimony is to provide revised
16 analyses that address the discrepancies regarding the transmission cost inputs in
17 EnCompass discussed above and incorporate updated natural gas costs from the
18 Company's new firm natural gas transportation contract.

19

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1 **Q. PLEASE EXPLAIN WHAT THE DISCREPANCIES IN TRANSMISSION**
2 **COSTS ARE.**

3 **A.** There were two. In PNM's original modeling, a portion of the transmission cost
4 for the Arroyo solar hybrid project was double-counted, and some of the inputs
5 for transmission costs regarding retail allocation was not applied to all candidate
6 resources used in modeling. PNM identified four projects which did not have the
7 required the retail allocator of 51.28 percent but instead used the 100 percent.

8
9 **Q. PLEASE DESCRIBE THE NEW FIRM NATURAL GAS**
10 **TRANSPORTATION CONTRACT?**

11 **A.** On December 2, 2019, PNM entered into an agreement with El Paso Natural Gas
12 to finalize the rate at which PNM would pay to deliver natural gas supply to the
13 San Juan site for the Pinon Gas Plant. In my previous testimony, PNM used a rate
14 of \$0.150 per mmBtu. The executed contract is for a rate of \$0.131 per mmBtu.

15
16 **Q. WHAT IS THE OVERALL IMPACT OF THESE CHANGES IN THE NPV**
17 **ANALYSES?**

18 **A.** After updating the transmission costs and natural gas transportation costs within
19 PNM's modeling, these updates did not change any of the resource selections in
20 PNM Scenarios 1 and 2. However, the updates did result in a change in the
21 associated NPVs for these scenarios in EnCompass, resulting in a lower NPV of
22 \$4 million for PNM Scenario 1 and \$3 million for PNM Scenario 2. Because this

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1 reduction in cost is relatively minor, PNM has not modeled these changes in
2 SERVVM and PowerSimm.

3
4 **X. RECOMMENDATION REGARDING MODELING ACCESS IN**
5 **FUTURE DOCKETS**

6 **Q. DO YOU HAVE ANY COMMENTS REGARDING THE ACCESS TO**
7 **MODELS THAT WAS PROVIDED TO PARTIES IN THIS DOCKET?**

8 **A.** Yes, I do. PNM wants to inform the Commission that PNM's process in
9 providing modeling access to parties (either through direct software access or
10 performing analyses on behalf of parties upon request) was expensive, both in
11 terms of monetary cost and business hours spent. PNM estimates that the total
12 cost for modeling-related requests and software will be approximately \$100,000
13 by the time the public hearings have concluded at the end of January 2020. PNM
14 recognizes that enhanced access to the models in this docket was warranted due to
15 the significance of taking the first step in the New Mexico energy transition.
16 Absent similar circumstances in future cases, however, PNM recommends that
17 parties be required to perform their own analyses and/or license their own
18 software. Of course, PNM would still supply all necessary data to ensure that
19 parties can perform their own analyses, as the Company has done in this
20 proceeding.

21

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1

XI. CONCLUSION

2 **Q. DOES THIS CONCLUDE YOUR REBUTTAL TESTIMONY?**

3 **A.** Yes, it does.

GCG#526585

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 escalated 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

**N THE MATTER OF PUBLIC SERVICE)
COMPANY OF NEW MEXICO'S)
CONSOLIDATED APPLICATION FOR)
APPROVALS FOR THE ABANDONMENT,)
FINANCING, AND RESOURCE REPLACEMENT)
FOR SAN JUAN GENERATING STATION)
PURSUANT TO THE ENERGY TRANSITION ACT)**


Case No. 19-00195-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 31st day of December, 2019.



NICHOLAS PHILLIPS

SUBSCRIBED AND SWORN to before me this 31st day of December, 2019.



OFFICIAL SEAL
TANYA D. ARAGON
NOTARY PUBLIC - STATE OF NEW MEXICO
My commission expires

January 31, 2023


NOTARY PUBLIC IN AND FOR
THE STATE OF NEW MEXICO

My Commission Expires:

January 31, 2023