PNM 20-Year Transmission Outlook

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Prepared by:

QUANTA TECHNOLOGY

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Foreword

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Table of Contents

Foreword i
1. Outlook Overview 4
1.1 Background 4
1.2 Objectives 6
1.3 Stakeholder Engagement 6
1.4 Study Limitations 6
2. Key Assumptions 8
2.1 Years 8
2.2 Load 8
2.3 Generation 9
2.4 System Operational Condition 11
2.4.1 Net Peak 12
2.4.2 Maximum Renewable 15
2.5 Transmission System 17
2.5.1 Conceptual Transmission Projects 17
2.5.2 Grid-Enhancing Technologies (GETs) 19
3. Study Methodology 21
4. Study Results 22
4.1 Evaluation of Conceptual Transmission Projects 22
4.2 Conceptual Transmission Project Cost Estimates & Schedule 24
5. Study Conclusions and Decarbonization Roadmap 25
5.1 Key Observations 25
5.2 Conceptual PNM Decarbonization Roadmap 26
5.3 Next Steps 27

List of Figures

Figure 1: High Level Overview of Planning Processes 5
Figure 2: Key Assumptions for 20-Year Transmission Outlook 8
Figure 3: Current Trends and Policy Load 9
Figure 4: Generation Additions 10
Figure 5: Generation Retirements 11

Figure 6: Daily PNM Load and Solar Chart 12
Figure 7: BA Generation Dispatch for Net Peak Scenario 14
Figure 8: BA Generation Dispatch for Maximum Renewable Scenario 16
Figure 9: Conceptual Transmission Projects 18
Figure 10: Conceptual PNM Decarbonization Roadmap 26

List of Tables

Table 1: PNM Generation Changes by Year 11
Table 2: BA Load for Net Peak Scenario 13
Table 3: Net Peak Scenario BA Generation Summary 14
Table 4: BA Load for Maximum Renewable Scenario 15
Table 5: Maximum Renewable Scenario BA Generation Summary 16
Table 6: Power Flow Performance Criteria 21
Table 7: PNM Exceptions to Criteria 21
Table 8: Conceptual Transmission Project Benefits 23
Table 9: Transmission Project Cost Estimates 24

1. Outlook Overview

PNM completed its first ever 20-Year Transmission Outlook, providing a strategic overview of the transmission infrastructure needed to reliably achieve the company's goal of 100% carbon-free energy. This outlook represents an initial step in identifying potential transmission concepts for the next two decades based on the results of PNM's 2023/2024 Integrated Resource Plan (IRP).

PNM believes that transmission expansion is a key element to ensuring a successful energy transition. To that end, PNM sought to create a prospective 20-year outlook to initiate a dialogue with a broad group of stakeholders with the goal of advancing some conceptual transmission additions that would serve to further New Mexico's energy future. PNM recognizes that meaningful collaboration will be essential to support significant transmission expansion in New Mexico.

It is important to note that PNM has not made any commitments to pursue approvals or proceed with construction of any projects or infrastructure identified in this document. All concepts presented are conceptual and will require additional detailed evaluations, and review to assess feasibility and guide future investment decisions.

The outlook is intended for Informational purposes only. A formal business case supported by more in-depth technical analysis is required before pursuing funding or regulatory approval for any specific project.

1.1 Background

PNM plays a pivotal role in the Western Interconnection, serving as both a Transmission Operator (TOP) and Transmission Owner (TO). Under its Federal Energy Regulatory Commission (FERC) approved Open Access Transmission Tariff (OATT), PNM provides open-access transmission services, ensuring safe and reliable operation of the grid for customers within its North American Electric Reliability Corporation (NERC) certified Balancing Authority (BA) area.

Given the growing complexity and challenges associated with new transmission development, a longer-term transmission outlook is essential to meet the future needs of PNM and the Western Interconnection. The 20-Year Transmission Outlook represents a foundational step in this direction, offering a strategic framework to guide future planning activities. The current planning practices often focus on near- to mid-term needs and do not provide a comprehensive longer-term perspective. This outlook helps fill that gap by identifying potential transmission concepts aligned with decarbonization goals and system growth.

Figure 1 show an overview of the planning processes employed by PNM to evaluate the future needs of its transmission system.

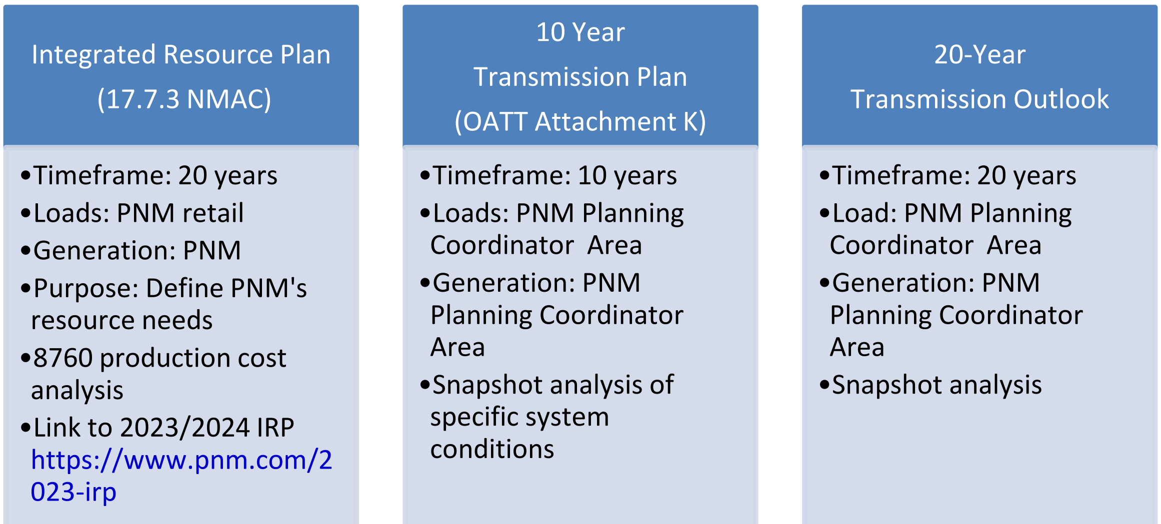

Figure 1: High Level Overview of Planning Processes

As a Transmission Planner (TP), PNM conducts annual assessments to address short- and long-term transmission needs, adhering to NERC's mandatory transmission planning Reliability Standards. These planning efforts support local system reliability, support integration of new generation resources and transmission facilities, accommodate long-term transmission service requests, and consider transmission needs driven by public policy.

As a public utility within New Mexico, PNM develops an IRP, adhering to 17.7.3 New Mexico Administrative Code (NMAC). The IRP identifies the most cost-effective mix of resources to meet the needs of PNM's retail customers while maintaining affordability, reliability, and resiliency.

On May 13, 2024, the FERC issued Order No. 1920, which also mandates long-term scenario-based regional transmission planning on a regional basis. Among its requirements, the order calls for a 20-year transmission planning horizon that incorporates a diverse set of scenarios and sensitivities. These must account for local, state, and federal laws and regulations related to:

- Generation resource mix and demand
- Decarbonization and electrification goals
- Fuel cost trends and resource retirements
- Generation interconnection requests
- Utility-specific commitments and policy objectives

In response, PNM's 20-Year Transmission Outlook represents an initial step toward establishing a long-term transmission planning process and inform the Order 1920 regional studies. This outlook is intended to shape the future design of PNM's electric transmission system and support the transition to a decarbonized generation portfolio.

Achieving these goals will require significant investment in the New Mexico transmission infrastructure. The potential solutions will require extensive planning, long lead time(s), and substantial capital investments.

1.2 Objectives

To support the transition to new generation resources, meet the growing demand from both new and existing loads, and enhance reliability and resiliency of the transmission system, PNM has extended its long-term planning horizon to 20 years. This expanded outlook provides a deeper understanding of the transmission infrastructure required to achieve its goals and objectives. The 20-Year Transmission Outlook evaluates the current transmission system to identify potential gaps in delivering power from new resources to load centers. It also assesses the effectiveness of conceptual transmission projects in addressing those gaps and supporting system transformation.

The core objectives of the transmission outlook in evaluating a conceptual *future* transmission system include:

1. **Serve Load:** Assess whether existing and proposed infrastructure can reliably meet future customer demand.
2. **Support the Transition to New Power Sources:** Enable integration of carbon-free generation resources in alignment with PNM's decarbonization goals.
3. **Provide Market Access:** Facilitate opportunities to buy/sell in regional energy markets.
4. **Improve Resilience and Reliability**: Minimize/reduce customer exposure to contingency events.
5. **Inform Regional Planning:** Concepts and insights for consideration in future regional planning processes.

1.3 Stakeholder Engagement

A key objective of the 20-Year Transmission Outlook is to communicate the potential investment and planning challenges associated with transitioning PNM's generation fleet with stakeholders.

PNM is committed to ongoing stakeholder engagement to gather feedback, identify community priorities, and build partnerships that will help advance transmission development and support the state's carbon-free objective.

In 2024, PNM hosted two stakeholder meetings:

- March 24, 2024 – The first meeting introduced the study objectives, scope, methodology, and assumptions, and provided an opportunity for stakeholders to offer input.
- November 12, 2024 – The second meeting presented the study results and outlined a roadmap for future planning and development.

All meeting notifications, presentations, and the full report are available on PNM's OASIS website and at https://www.pnm.com/planning-for-the-future.

1.4 Study Limitations

All planning studies represent a snapshot in time, reflecting specific operational conditions and potential system configurations. As such, they inherently carry technical limitations. Extending the planning horizon to 20-year, as done in this 20-Year Transmission Outlook, introduces additional uncertainties and complexities. Key challenges include:

- **Load Forecast Variability:** Load forecasts are estimates, as they rely on a forecasted set of assumptions. Unanticipated economic growth or downturns are difficult to predict and may significantly alter demand projections.
- **Ultimate Resource Locations:** Ultimate resource locations are unknown until PNM conducts a RFP process, pursuant to the IRP Rule, for specific resources in specific locations. The location of specific resources will impact planning assumptions for transmission improvements.
- **Transmission Corridor Development:** Construction of new greenfield transmission lines is a time-intensive process. Identifying and securing optimal routes can be time consuming and must consider environmental, regulatory, and land-use constraints, which may affect routing and cost.
- **Policy and Regulatory Changes**: The regulatory environment is dynamic. Shifts in local, state, or federal policies over the next 20 years can significantly impact project timelines, costs, and overall planning assumptions.
- **Cost Estimates Variability:** Cost estimates are subject to fluctuations in labor, materials, and market conditions. This outlook does not account for differences in future cost variability, which could influence project economics.

Understanding these limitations is essential for interpreting the findings and conclusions of this outlook. Technology advancements may introduce new solutions, or render previously infeasible options viable, potentially reshaping long-term transmission strategies. Future planning efforts will continue to refine, reduce uncertainty, and support more informed, adaptive decision-making as the energy landscape evolves.

2. Key Assumptions

To evaluate PNM's transmission system and its ability to support the projected load and generation growth outlined in the IRP, a series of power flow models were developed using the key assumptions described in this document.

These assumptions are organized into five categories as shown in Figure 2.

Years	Load	Generation	System Operational Conditions	Transmisison System
• 2028 • 2033 • 2040	• Current Trends and Policy • High Econmic Growth	• Additions • Retirements • Resouce Type	• Net Peak • Maximum Renewable	• Conceptual projects

Figure 2: Key Assumptions for 20-Year Transmission Outlook

2.1 Years

The 20-Year Transmission Outlook is a point in time study designed to evaluate system conditions spanning the entire 20-year planning horizon. To capture the range of expected conditions over this period, three representative years were selected to reflect near-term, mid-term, and long-term system scenarios.

- 2028 (near-term)
- 2033 (mid-term)
- 2040 (long-term)

2.2 Load

PNM's IRP utilized various load forecast assumptions to investigate a range of possible long-term outcomes.

For the purposes of the 20-Year Transmission Outlook, the following two load forecasts were utilized in the analysis:

- **Current Trends and Policy (CTP):** This scenario reflects the best estimates of the future conditions based on the knowledge at the time of the IRP's development. It assumes moderate local economic growth and accelerating electric vehicle (EV) adoption, partially offset by increased customer adoption of rooftop solar. The result is relatively modest growth in system needs, with projected annual increases of 0.4% in energy and 0.9% in peak demand.

- **High Economic Growth (HEG):** This scenario envisions a future characterized by rapid economic expansion in New Mexico. It includes higher levels of customer adoption of both solar resources and EVs, leading to significantly increased electric demand and more aggressive system growth.

These scenarios provide a framework for evaluating how different economic and technological trajectories may impact the transmission system over the 20-year planning horizon.

Figure 3 compares the historical Balancing Area load for 2024 with the projected load in the 20-Year Transmission Outlook for the CTP scenario.

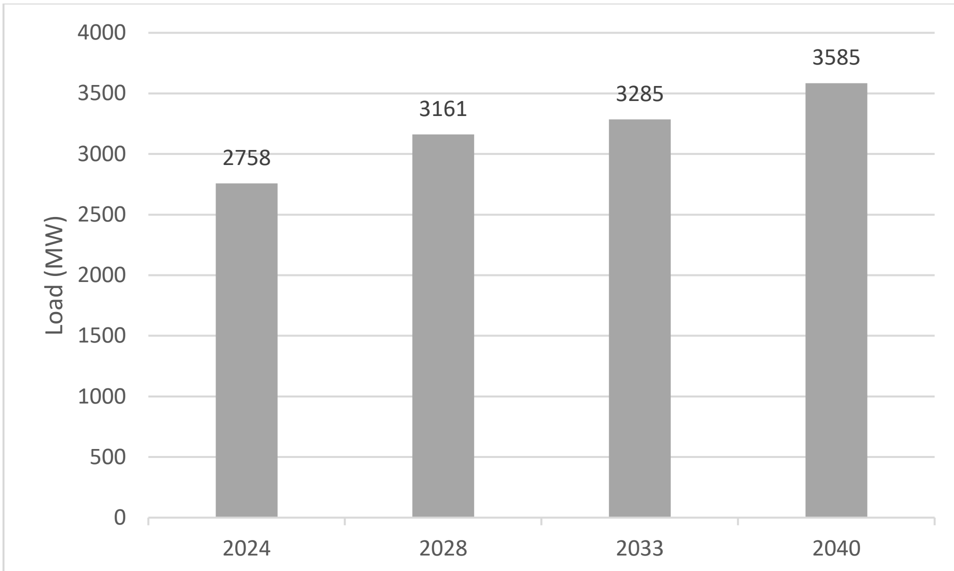

Figure 3: Current Trends and Policy Load

For the HEG scenario an additional 370 MW of load was added to represent anticipated demand from large customers. The 20-Year Transmission Outlook under this scenario reflects a 44% cumulative load growth by 2040, highlighting the significant impact of accelerated economic development and electrification trends on the transmission system.

2.3 Generation

PNM's existing generation portfolio consists of a diverse mix of nuclear, coal, natural gas, solar, wind, geothermal, and energy storage resources. Over the next eight years, several of these resources are expected to exit the portfolio due to expiring power purchase agreements or retirements, while others remain in operation for up to 20 more years.

Currently, PNM's nuclear, wind, solar, and energy storage resources[1] supply enough carbon-free energy to meet half of its retail electricity demand. These existing resources and future carbon-free additions will play a critical role in helping PNM achieve its goal of a carbon-free energy system.

To reach this goal, PNM's IRP evaluated a range of technology and capacity scenarios. The "All Technologies" scenario, was selected for future resource planning due to its cost-effectiveness and to mitigate risk. This scenario includes a balanced mix of renewables, energy storage, demand-side programs, and hydrogen-ready thermal resources.

[1] This includes both PNM-owned resources as well as purchased power agreements.

Figure 4 shows the generation additions by fuel types throughout the 20-Year Transmission Outlook. It highlights both existing generation and the additional capacity expected to be added over time.

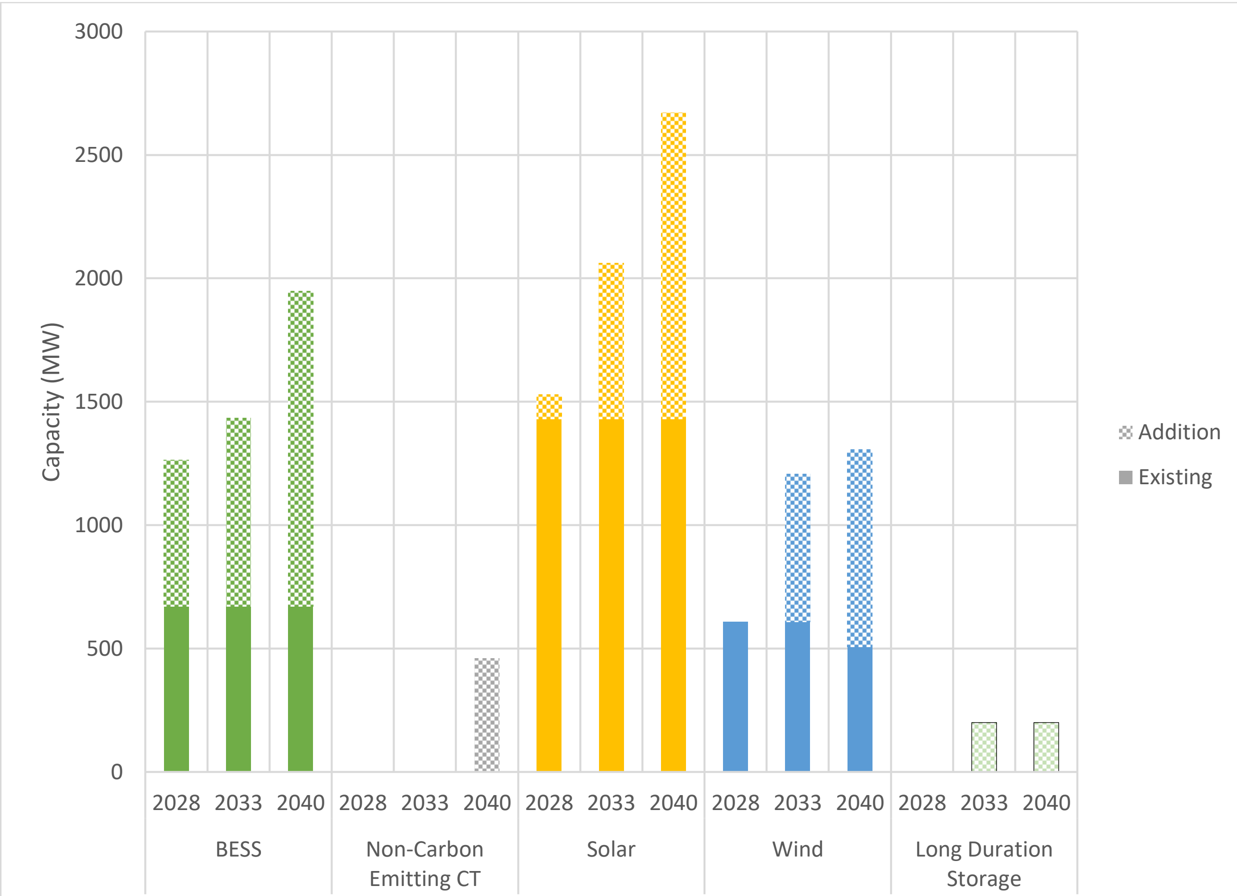

Figure 4: Generation Additions

Figure 5 shows the resource types scheduled for retirement during the 20-Year Transmission Outlook period. The graph shows the existing generation levels in 2025 with projected generation levels for each study year included in the outlook, highlighting the gradual phase-out of specific resources over time.

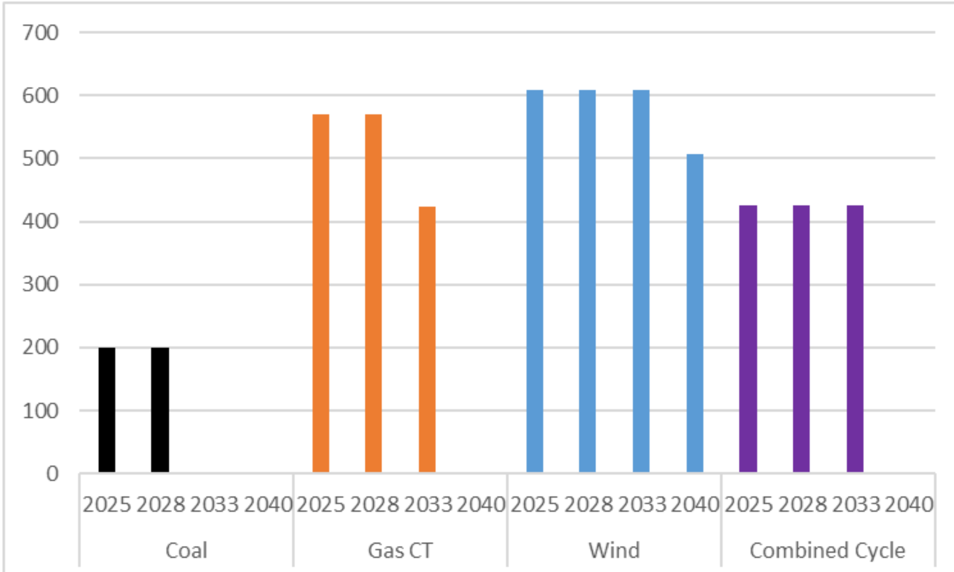

Figure 5: Generation Retirements

Table 1 shows the year-by-year changes in PNM's generation portfolio, culminating in the total projected generation for each resource type by 2040.

Table 1: PNM Generation Changes by Year

Fuel Type	Existing (MW)	2028 Additions (MW)	2033 Additions (MW)	2040 Additions (MW)	Total in 2040
Battery Energy Storage System (BESS)	670	593	170	516	1949
Non-Carbon Emitting CT	0	0	0	460	460
Solar	1430	100	533	609	2672
Wind	608	0	600	98[2]	1306
Long Duration Storage (LDS)	0	0	200	0	200
Coal	200	0	-200	0	0
Gas CT	570	0	-146	-424	0
Combined Cycle	425	0	-425	0	0
Nuclear	288	0	0	0	288
Geothermal	15	0	0	0	15

2.4 System Operational Condition

PNM's transition to carbon-free energy will significantly reshape how its system operates. Currently, coal and gas are used to balance the load and maintaining reliability. In the future, however, PNM will

[2] Net increase in wind. 200 MW increase and 102 MW retirement from expiring power purchase agreements.

increasingly rely on energy storage, flexible gas resources, and renewable energy curtailment to dynamically manage the system.

To address these evolving operational challenges, PNM included two key system operational conditions into its 20-Year Transmission Outlook: *Net Peak* and *Maximum Renewable*. The assumptions underlying these scenarios are described in the following sections.

2.4.1 Net Peak

The first operating scenario selected is the *Net Peak* condition. As renewable energy grows, the most challenging period for maintaining reliability will shift from the traditional afternoon peak to the early evening when solar generation declines. This scenario represents the early evening hours when the solar generation has significantly declined after sunset, yet system demand remains high a pattern commonly referred to as the "solar duck curve." During this period, the grid must rely entirely on non-solar resources to meet demand, making it a critical time for system reliability and flexibility.

Figure 6 illustrates an example of this operating condition using historical data from a day in July 2023.

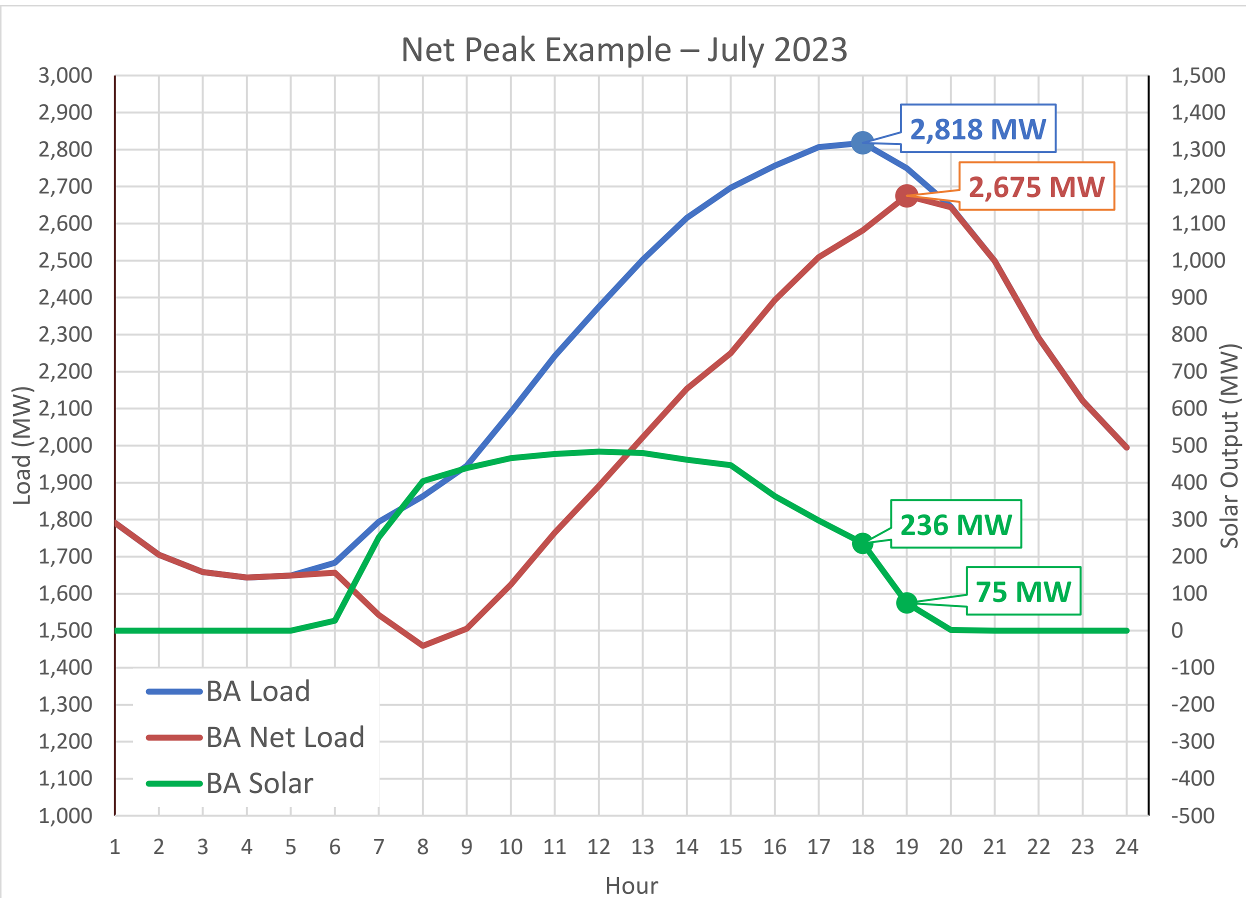

Figure 6: Daily PNM Load and Solar Chart

The BA net load is defined as the total BA load minus the BA solar generation. When the solar is at 0 MW, the net load equals the BA load. As solar generation increases during the day the net load begins to decrease. Once solar output reaches its maximum output, typically between 10:00 AM and 2:00 PM, the net load begins to rise again as overall demand continues to increase while solar plateaus.

The BA peak load occurred at 6:00 PM. At that time, solar generation was serving about 8% of the load. By 7:00 PM, the load had only slightly decreased, but the solar generation output had dropped significantly, covering just 3% of the load. This sharp decline in solar contribution, while demand remains high, defines the Net Peak condition.

To define this condition for the 20-Year Transmission Outlook, hourly historical data was analyzed to determine the Net Peak demand level. This analysis was conducted monthly and benchmarked against the annual peak for 2023. The results determined that the Net Peak represented 95% of the PNM BA Load peak.

Table 2 presents the BA load values used in the Net Peak scenario.

Table 2: BA Load for Net Peak Scenario

2028		2033		2040	
CTP	HEG	CTP	HEG	CTP	HEG
3,003	3,375	3,121	3,491	3,406	3,776

Additionally, during the Net Peak operating condition, the available capacity for variable renewable resources is adjusted to reflect typical performance during this period. Solar generation is assumed to contribute 0%, as it occurs after sunset, while wind generation is represented at 10% of its nameplate capacity, based on historical performance data.

The remaining resource needs are met using available dispatchable resources, including energy storage systems and power purchase agreements, all while maintaining system reserve requirements.

Figure 7 and Table 3 summarize key details of the Net Peak scenario model.

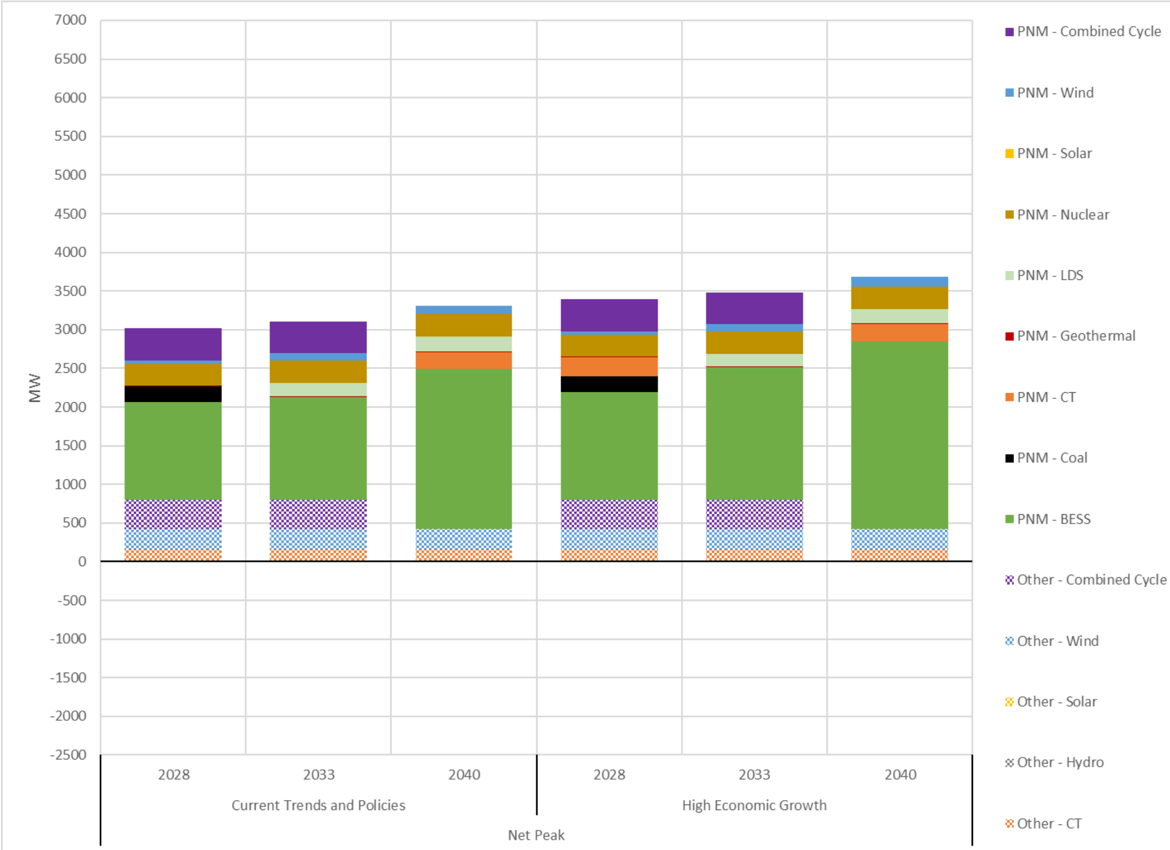

Figure 7: BA Generation Dispatch for Net Peak Scenario

Table 3: Net Peak Scenario BA Generation Summary

	2028		2033		2040	
Generation Fuel Type	**CTP**	**HEG**	**CTP**	**HEG**	**CTP**	**HEG**
Battery Energy Storage System (BESS)	1,263	1,391	1,333	1,717	2,067	2,431
Non-Carbon Emitting CT	0	0	0	0	219	222
Solar (0%)	0	0	0	0	0	0
Wind (10%)	287	287	347	347	357	377
Long Duration Storage (LDS)	0	0	170	161	198	184
Coal	200	200	0	0	0	0
Gas CT	160	408	160	160	160	160
Combined Cycle	797	799	783	783	0	0
Nuclear	288	288	288	288	288	288
Geothermal	10	10	10	10	10	10
Hydroelectric	10	10	10	10	10	10

2.4.2 Maximum Renewable

The second operating scenario selected is the *Maximum Renewable* condition. This scenario captures mid-day hours when the renewables (e.g., wind and solar) are producing at or near their coincident peak capacity. During this period, the BA generation exceeds the load and relies on charging energy storage systems and exporting excess energy as much as possible within transmission constraints to reduce generation curtailment.

PNM analyzed hourly historical data from 2023 to define this condition for the 20-Year Transmission Outlook. The Top 30 hours of maximum combined renewable output on PNM's system was identified and ranked. This analysis established representative capacity levels for renewable resources and load during this scenario.

Based on the findings:

- Solar is represented at 80% of its nameplate capacity
- Wind is represented at 95% of its nameplate capacity
- PNM BA Load is assumed to be 40% of peak load

The remaining system needs are met using available resources, including energy storage systems, flexible generation, and power purchase agreements, while maintaining system reserve margins.

Table 4,Table 5, and Figure 8 summarize key details of the Maximum Renewable scenario model.

Table 4: BA Load for Maximum Renewable Scenario

2028		2033		2040	
CTP	HEG	CTP	HEG	CTP	HEG
1,300	1,670	1,347	1,717	1,467	1,837

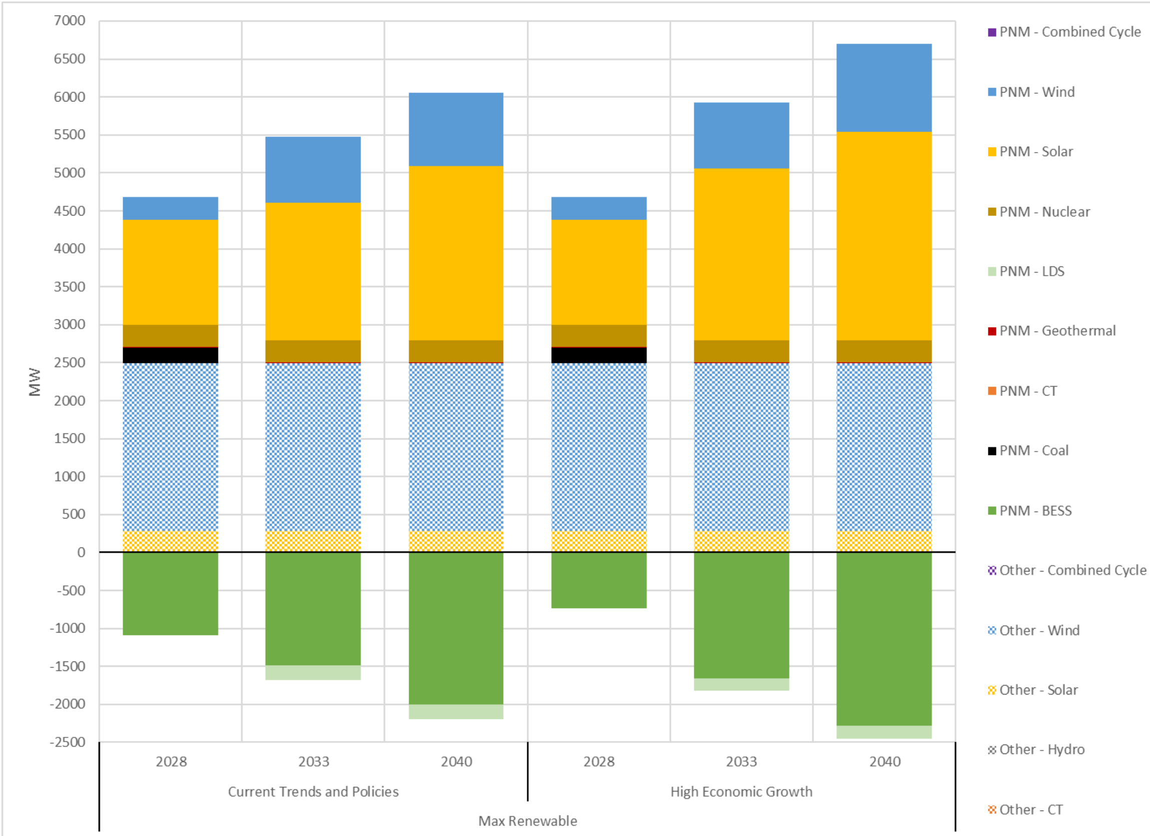

Figure 8: BA Generation Dispatch for Maximum Renewable Scenario

In the Maximum Renewable scenario, negative generation values represent the charging of energy storage systems. During periods of excess renewable output, energy storage systems are prioritized for charging before any surplus energy is exported from the system.

Table 5: Maximum Renewable Scenario BA Generation Summary

	2028		2033		2040	
Generation Fuel Type	CTP	HEG	CTP	HEG	CTP	HEG
Battery Energy Storage System (BESS)	-1,089	-733	-1,484	-1,656	-1,997	-2,278
Non-Carbon Emitting CT	0	0	0	0	0	0
Solar (95%)	1,655	1,655	2,081	2,529	2,568	3,016
Wind (80%)	2,515	2,515	3,087	3,087	3,180	3,370
Long Duration Storage (LDS)	0	0	-200	-162	-200	-178
Coal	200	200	0	200	200	0
Gas CT	0	0	0	0	0	0
Combined Cycle	0	0	0	0	0	0
Nuclear	288	288	288	288	288	288
Geothermal	10	10	10	10	10	10
Hydroelectric	30	30	30	30	30	30

2.5 Transmission System

PNM's bulk transmission system consists of 345 kV and 230 kV transmission lines. At major load centers, transformers step down voltages to 115 kV, while substations on 115 kV, 69 kV, and 46 kV lines further reduce voltages for delivery to customers.

In northern New Mexico, power typically flows into New Mexico during periods of low renewable generation, driven by baseload generation in the Four Corners area and in Arizona. During times of high renewable generation output the power flow is reversed with renewable generation exports utilizing firm transmission service for non-PNM eastern New Mexico wind farms. The key elements of PNM's existing transmission system include:

- The high voltage backbone between Four Corners and the northern load center.
- The high voltage transmission lines linking Four Corners to southern New Mexico.
- The eastern high voltage transmission lines, which facilitate delivery of wind resources to PNM's system and beyond.

Currently, wholesale customers account for about 50% of the utilization of PNM's transmissions system to provide renewable resources to regional area loads. However, as PNM and neighboring utilities transition to a more dispersed and renewable-heavy generation mix, transmission system usage patterns will continue to evolve. In response, maintaining, operating, and expanding the transmission network will be essential to ensure reliable delivery of future energy resources to both new and existing load centers.

Refer to Section 4, PNM's Existing System, of the PNM 2023 IRP for more information. (https://www.pnm.com/2023-irp)

The current system with projects identified through the PNM 10 Year Plan served as the foundation of the transmission system for the 20-Year Transmission Outlook.

2.5.1 Conceptual Transmission Projects

PNM currently has several conceptual Transmission Projects that while not included in its current 10-year planning horizon are considered viable alternatives or additions to the transmission system. The projects were selected based on expert judgment informed by potential resource location, utilization of existing transmission, planned merchant projects, other system studies (e.g., generation interconnections, IRP), and export potential.

These Transmission Projects are shown in Figure 9 and were evaluated for their potential to:

- Meet performance and reliability criteria for the system.
- Enhance the delivery of power from new energy resources to load centers within PNM's service territory and beyond.
- Increase load serving capability to prospective economic development loads.

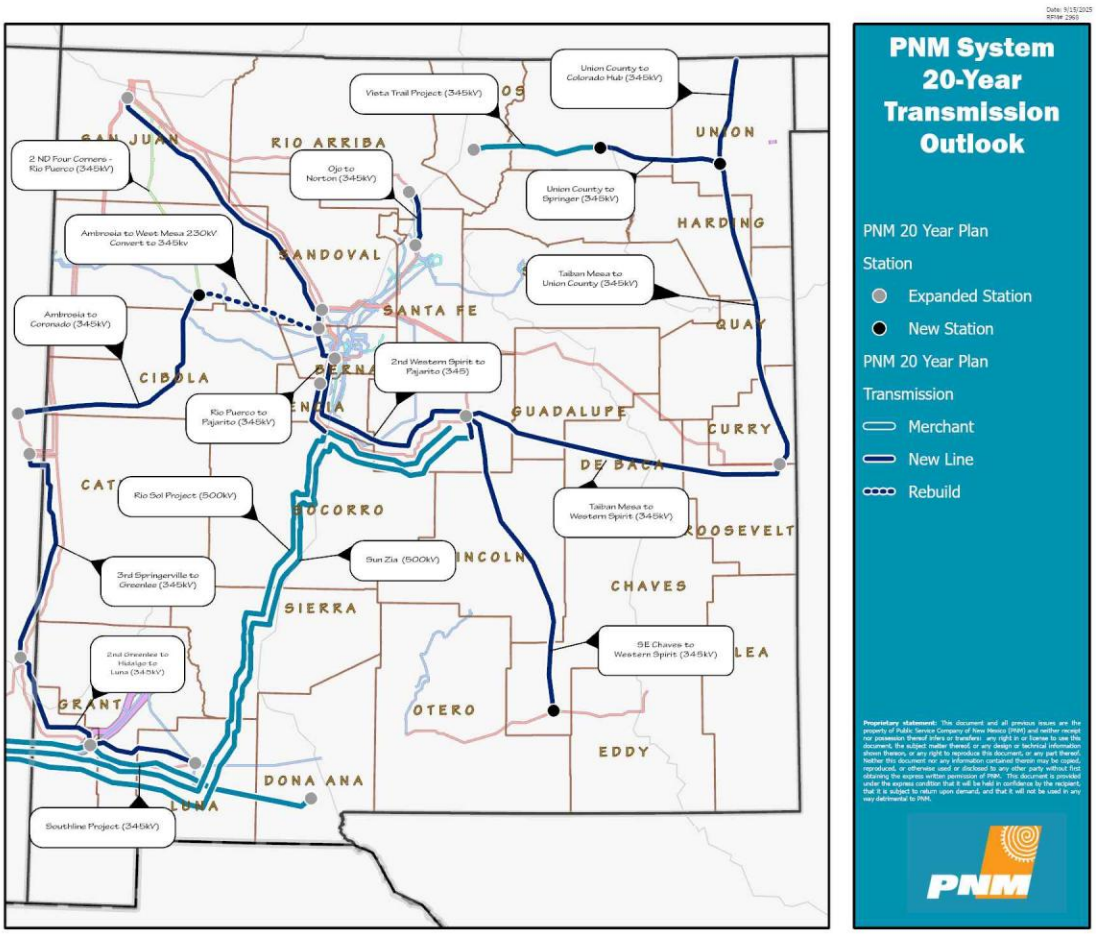

Figure 9: Conceptual Transmission Projects

2nd Four Corners-Rio Puerco 345 kV

Provides additional reliability through redundancy for the path from Four Corners to Albuquerque; Provides additional capacity for imports from and exports to Arizona.

West Mesa – Ambrosia 230 kV Convert to 345 kV

Provides additional capacity for imports from and exports to western New Mexico; When combined with Ambrosia to Coronado it provides additional capacity for imports from and exports to Arizona.

Ambrosia – Coronado 345 kV

Provides a new connection to Arizona; Provides additional capacity for imports from and exports to Arizona.

Ojo – Norton 345 kV

Provides additional reliability through redundancy and more capacity for the existing path from Albuquerque to northeast New Mexico.

Rio Puerco – Pajarito 345 kV and Pajarito - Prosperity 345 kV

Provides additional reliability through redundancy and more capacity for the existing path into Albuquerque by adding a new 345 kV path.

2nd Western Spirit – Hidden Mountain – Pajarito 345 kV

Provides additional reliability through redundancy and more capacity for the existing path from Western Spirit to Pajarito 345 kV; Supports additional transfer capability to bring generation to load centers.

Rio Sol Merchant Transmission Line and 345 kV Connection to PNM

Provides connection to a 500 kV AC merchant transmission line from Central New Mexico to Arizona. A 345 kV connection to the PNM transmission system provides a new source of renewable energy to import power from Eastern New Mexico.

Sun Zia Merchant Transmission Line and 345 kV Connection to PNM

Provides connection to the AC collector station associated with the 500 kV DC transmission line from Central New Mexico to Arizona. A 345 kV connection to the PNM transmission system provides a new source of renewable energy to import power from Eastern New Mexico.

Taiban Mesa – Western Spirit 345 kV

Provides additional reliability through redundancy and more capacity for the existing path from Eastern New Mexico to Albuquerque; Complementary with Union County – Taiban Mesa 345 kV.

Union County – Springer 345 kV

Provides connection to the Vista Trail Project which provides another East-West path for power to travel.

Union County – Colorado Hub 345 kV

Provides a new source for PNM to import power from or export power to Colorado; Complementary with other Union County projects.

Union County – Taiban Mesa 345 kV

Provides additional routes for power to flow should contingency events prohibit the existing path to Albuquerque; Complementary with other Union County projects.

SE Chaves County – Western Spirit 345 kV

Provides a new source for PNM to transfer power between Northen and Southern New Mexico; Provides additional capability and access to renewables in the area to transfer power to Albuquerque.

3rd Springerville-Greenlee 345 kV

Provides additional capacity for imports from and exports to Arizona.

2nd Greenlee-Hidalgo-Luna 345 kV

Provides additional capacity for imports from and exports to Arizona.

Southline Project

A merchant transmission project. 345 kV AC transmission line from Southwest New Mexico to Arizona.

Vista Trails Project

A merchant transmission project. 345 kV AC transmission line from in Northern New Mexico.

2.5.2 Grid-Enhancing Technologies (GETs)

GETs are innovative solutions designed to optimize the performance of existing transmission infrastructure, improving efficiency and enabling the grid to manage increased electricity demand without the immediate need for new transmission line construction. GETs includes the following:

- **Dynamic Line Rating (DLR):** Adjusts the real-time capacity of transmission lines based on environmental conditions (e.g., temperature, wind) and physical facility limitations, allowing lines to safely carry more electricity when conditions permit.

- **Power Flow Control Devices:** Help balance the grid by redirecting electricity to underutilized lines, reducing congestion and improving system flexibility.
- **Advanced Conductor:** High temperature, low sag carbon core conductor capable of increased capacity over similar ASCR alternatives.
- **Topology Optimization:** Help supporting stability analysis, grid strength, short circuit levels, and understand impacts on markets and existing resources.
- **Remedial Action Scheme (RAS):** Automated control systems that detect abnormal grid conditions and take predefined corrective actions such as adjusting generation or shedding load to maintain system stability and prevent cascading outages

These technologies can improve reliability and resilience, thereby reducing the risk of outages and ensuring a stable electricity supply.

PNM already extensively utilizes GETs, as defined above, to optimize the use of the PNM transmission system. PNM uses series reactors and series capacitors to redirect electricity and RAS to optimize the system under specific low probability events. More recently, PNM installed a phase-shifting transformer to allow for the interconnection of additional renewable resources in northern New Mexico while maintaining system reliability.

PNM, and the electric industry at large, are currently subject to additional requirements to include GETs solutions in transmission system studies, including in FERC Orders 1920 and 2023.

3. Study Methodology

To evaluate PNM's transmission system capacity to accommodate projected demand growth while ensuring reliability and adaptability for future generation resources, a Power Flow Analysis was conducted on the scenarios outlined in Section 2. This analysis assessed the current transmission system across the study horizon and examined the potential impact of conceptual Transmission Projects to meet all lines in service and single contingency transmission planning criteria.

The scope of the analysis was limited to steady state analysis. Further studies of voltage stability, short circuit, and transient stability will need to be performed before moving forward with any system improvements.

Additionally, the analysis focused solely on the conceptual projects identified in the 20-Year Transmission Outlook. *Please note that significant upgrades to the local 115 kV networks will be required to serve the projected load growth, however, those were beyond the scope of this outlook.*

The power flow analysis was performed using PowerGEM's Transmission Adequacy & Reliability Assessment (TARA) software package and GE PSLF. The analysis evaluated the thermal and voltage performance of PNM's transmission system for the scenarios under Category P0 (all elements in service) and Category P1 (N-1, single contingency) conditions. PNM observes the criteria from TPL-001-WECC-CRT-4 Transmission System Planning Performance, as shown in Table 6. PNM exceptions to these criteria are shown in Table 7.

Table 6: Power Flow Performance Criteria

Under Frequency Limit	Loading Limits	Voltage (pu)	Voltage Deviation
P0	< Normal Rating	0.95–1.05 pu	N/A
P1	< Emergency Rating	0.90–1.10 pu	8%

Table 7: PNM Exceptions to Criteria

Category	Element	Exception Type	Exception
P0	Taiban Mesa 345 kV Bus	Voltage	0.95–1.10 pu
P0	Guadalupe 345 kV Bus	Voltage	0.95–1.10 pu
P0	Clines Corners 345 kV Bus	Voltage	0.95–1.10 pu
P0	Jicarilla 345 kV Bus	Voltage	0.95–1.10 pu

RAS operations were simulated as part of the contingency analysis and considered part of the available post-contingency mitigation measures. Generation was re-dispatched in instances where re-dispatching could mitigate thermal overloads.

Facilities owned by PNM and its neighboring utilities were monitored and evaluated against applicable performance criteria. Any violations identified during the analysis were reviewed and documented accordingly.

Any additions PNM makes to its transmission system will require thorough analysis and meet all required transmission system planning criteria, including those beyond all lines in service and single contingency scenarios.

4. Study Results

In the **Net Peak** scenario, the 20-Year Transmission Outlook confirmed that PNM's transmission system is capable of reliably delivering IRP resources to meet projected future load, including under the High Economic Growth scenario. **However, during certain contingencies, overloads were identified on the underlying 115 kV system in the Albuquerque area. As noted above, additional improvements will be necessary to address these localized overloads.**

In the **Maximum Renewable** scenario, the analysis confirmed that the system's current export capacity is fully utilized with existing resources. Nonetheless, the inclusion of conceptual transmission projects enhanced system capability enabling the export of renewable resources at levels up to twice the PNM BA area load.

4.1 Evaluation of Conceptual Transmission Projects

New transmission development offers a range of potential strategic benefits to the grid:

- **Supports Additional Load Growth**: Can enable service to new load growth, including those driven by economic development opportunities.
- **Increases Market Access:** Can enhance access to regional markets, promoting efficient use of clean energy resources across a wide geographic area and improving resilience during extreme weather events.
- **Improves System Reliability and Resilience:** Can strengthens the system's ability to withstand planned or unplanned outages, as well as extreme weather conditions. Can enable future deployment of advanced conductor technologies rebuilds in the Albuquerque metro area and other load centers by sufficiently offloading existing lines to accommodate construction.
- **Expands Access to Renewable Resources**: Can provide increased access to New Mexico's abundant wind, solar, and other renewable energy resources.
- **Enables Fossil Generation Retirement**: Can support the future retirement of existing fossil fuel generation, particularly in load center areas.

The following conceptual transmission projects were evaluated but deferred, as the scenarios modeled in the 20-Year Transmission Outlook do not represent the conditions under which these projects would provide maximum benefit.

- 2nd Greenlee-Hidalgo-Luna 345 kV
- 3rd Springerville-Greenlee 345 kV
- Southline Project
- Vista Trails Project

Table 8 summarizes the benefits of the evaluated conceptual Transmission Projects. The additional capacity values presented are approximate and intended to provide a general indication of system enhancement potential. The additional load serving and market access values are preliminary and provided as in indication of the magnitude of the value added by the project. Additional study work is required to determine the additional capacity.

Table 8: Conceptual Transmission Project Benefits

Conceptual Transmission Project Description	Approximate Additional Load Serving	Approximate Additional Market Access	Expands Access to Renewable Resources	Enables Fossil Generation Retirement	Improves System Reliability and Resilience
Rio Puerco – Pajarito 345 kV	600 MW[1]	0 MW	No	Yes	Yes
Pajarito – Prosperity 345 kV	600 MW[1]	0 MW	No	Yes	Yes
Rio Sol 345 kV Connection to PNM	600 MW	1,500 MW[1]	Yes[1]	No	No
Sun Zia 345 kV Connection to PNM	0 MW[2]	700 MW	No[1]	No	No
2nd Western Spirit – Hidden Mountain –Pajarito 345 kV	600 MW	0 MW[1]	Yes	Yes	No
SE Chaves County – Western Spirit 345 kV	0 MW[1]	1,000 MW	Yes	No	No
2nd Four Corners – Rio Puerco 345 kV	1,000 MW	1,000 MW	Yes	Yes	No
West Mesa – Ambrosia 230 kV Convert to 345 kV	600 MW	0 MW[2]	No	No	No
Ambrosia – Coronado 345 kV (Arizona)	600 MW	1000 MW	No	No	No
Taiban Mesa – Western Spirit 345 kV	0 MW[1]	0 MW[1]	Yes[1]	No	No
Taiban Mesa – Union County – Colorado Hub 345 kV	1,000 MW	200 MW	Yes[1]	No	No
Ojo – Norton 345 kV	700 MW	450 MW	No[1]	Yes	No
Union County – Springer 345 kV	0 MW[1]	500 MW	Yes[1]	No	No

1 When paired with certain other transmission solutions could create additional benefits.

[ ] Complementary Projects

4.2 Conceptual Transmission Project Cost Estimates & Schedule

The high-level estimates provided in Table 9 are intended to illustrate the general magnitude of cost and time required to implement necessary transmission infrastructure. The estimates are based on standard assumptions and do not factor in project specific details like right-of-way (ROW) acquisition, permitting processes, and construction related outages.

The estimates apply only to the evaluated conceptual transmission projects and exclude merchant transmission projects. Additionally, they do not reflect evolving procurement timelines and cost associated with long lead equipment.

Table 9: Transmission Project Cost Estimates

Project Description	Years	Est. Cost ($M) in 2024$
Rio Puerco – Pajarito 345 kV Line	4 – 5	$120 – $132
Pajarito – Prosperity 345 kV Line	3.5 – 4.5	$65 – $72
Rio Sol 345 kV Connection to PNM	4 – 6	$170 – $185
Sun Zia 345 kV Connection to PNM	4 – 6	$47 – $55[1]
2nd Western Spirit – Hidden Mountain –Pajarito 345 kV	5 – 7.5	$445 – $480
SE Chaves County – Western Spirit 345 kV Line	7 – 10	$510 – $540
2nd Four Corners – Rio Puerco 345 kV	8 – 10	$375 – $410
West Mesa – Ambrosia 230 kV Convert to 345 kV	7 – 8.5	$310 – $340
Ambrosia – Coronado (Arizona) 345 kV Line	7 – 9	$430 – $460
Taiban Mesa – Western Spirit 345 kV Line	6 – 8.5	$325 – $350
Union County – Taiban Mesa 345 kV Line	6 – 10	$400 – $430
Union County – Colorado Hub 345 kV	8 – 10	$415 – $460
Ojo – Norton 345 kV Line	5 – 7.5	$150 – $218
Union County – Springer 345 kV Line	6 – 8.5	$160 – $180

[1] Unknown requirements for equipment/materials.

5. Study Conclusions and Decarbonization Roadmap

In 2023, PNM finalized its IRP outlining a strategy pathway for achieving a carbon-free electric system in accordance with the Energy Transition Act and the Renewable Energy Act. The IRP evaluated multiple potential load growth scenarios, the planned retirement or expiration of power purchase agreements for generation resources, and various renewable generation options. The objective was to design a reliable system that complies with regulatory standards and requirements, reduces environmental impacts, and minimizes costs to customers.

The IRP planning horizon spans 20 years, during which PNM's generation resource portfolio will undergo a significant transition in both the location of the capacity and fuel type. To enable this shift and enable a decarbonized generation portfolio, substantial investment in the New Mexico transmission infrastructure will be essential. Many of the available options will require years of preparation, planning, and capital investment to transform the transmission system in readiness for the future renewable generation fleet. The PNM 20-Year Transmission Outlook (2024) evaluated PNM's existing transmission system topology alongside various conceptual future configurations. Overall, the conceptual Transmission Projects have the potential to strengthen PNM's system, facilitating the energy transition by enhancing reliability and capacity for power transfer across New Mexico to PNM load centers as well as to neighboring utilities and regional markets.

5.1 Key Observations

New greenfield transmission is essential to deliver power from future generation resources to the load centers within PNM's system, aligning with New Mexico's and PNM's objective to achieve a carbon-free electric grid. Key benefits include:

- **Supporting Load Growth and Economic Development:** Enables service to expanding areas and supports new economic opportunities.
- **Enhancing Market Access:** Improves connectivity to regional markets, facilitating efficient use of clean energy and bolstering resilience during extreme weather events.
- **Unlocking Renewable Resource Potential:** Increases access to New Mexico's abundant wind, solar, and other renewable resources, reducing reliance on carbon-based generation.
- **Improving System Reliability and Resilience:** Strengthens the grid's ability to withstand planned and unplanned outages, as well as extreme weather conditions.
- **Enabling Interstate Expansion:** Supports broader regional transmission initiatives and cross-border energy exchange.

Alternative solutions to new transmission will need to be developed and analyzed to address concerns and challenges in the Albuquerque area (115 kV system) during peak operational conditions.

- **GETs:** Tools like Dynamic Line Ratings (DLR) can help manage congestion, reduce curtailment, support maintenance, and defer major upgrades.
- **Reconductoring Existing Lines:** Upgrading conductors can increase capacity in congested corridors without requiring new rights-of-way.
- **Local Generation Development:** Deploying resources such as energy storage (e.g., BESS) within the load center can reduce reliance on long-distance imports.
- **Reactive Power Compensation:** Additional reactive power compensation projects, such as Static VAR Devices (SVDs), STATCOMs, or similar technologies, may be required to address

potential voltage stability issues associated with the implementation of the conceptual transmission projects.

- **RAS:** As new transmission projects are commissioned, the effectiveness and coordination of existing RAS across the PNM system will need to be reassessed to ensure continued system reliability and compliance with planning standards.

5.2 Conceptual PNM Decarbonization Roadmap

Figure 10 illustrates PNM's current conceptual roadmap for achieving decarbonization. This roadmap outlines a high-level strategic approach and should not be interpreted as a detailed construction or implementation plan. This roadmap will continue to evolve as the system changes and technology advances.

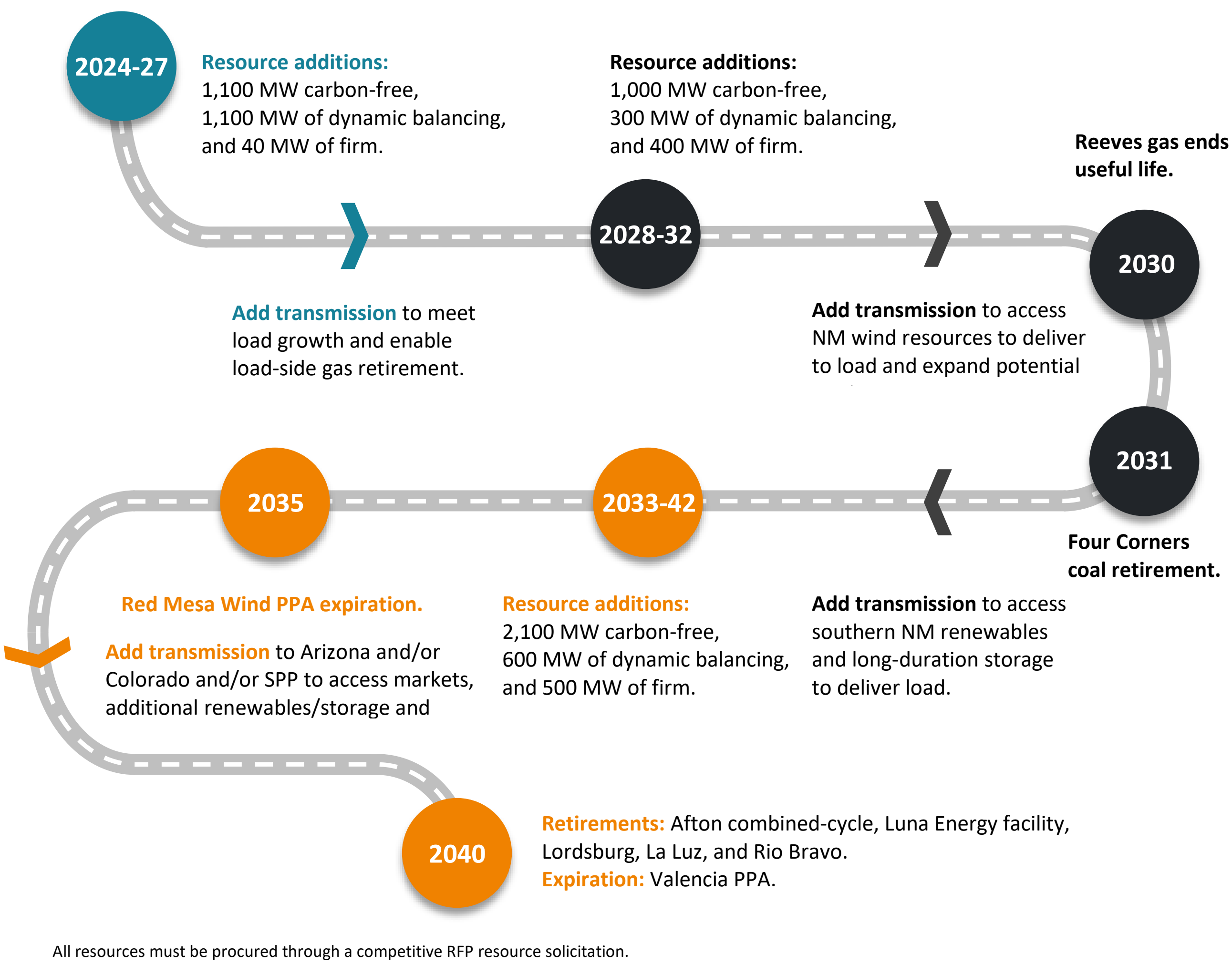

Figure 10: Conceptual PNM Decarbonization Roadmap

5.3 Next Steps

This 20-Year Transmission Outlook provides high level insights to support the development of a transmission system that enables PNM to achieve its decarbonization goals, while also increasing load serving capacity and facilitating export of New Mexico renewable resources. However, further work is required to expand the transmission to fully meet customer needs and contribute to the broader Western Interconnection.

Future Technical Studies

Additional technical studies will be required to support investment decisions and development of transmission in New Mexico.

- **Continuous Improvement:** Refine 20-year planning methodologies for future studies and conduct periodic evaluations to align with the IRP.
- **Economic Benefits:** Evaluate the economic value of the conceptual projects, including cost savings, congestion relief, and economic feasibility (i.e., nodal model analysis).
- **Incorporate Insights from Related Studies:** Incorporate findings from other relevant studies to inform the evaluation of conceptual projects.
- **Examine Alternative Scenarios:** Analyze additional scenarios such as gross peak conditions to test project performance under a broader range of system conditions.
- **Expand analysis:** Quantify the maximum possible increased load-serving and export capacity resulting from the projects beyond the levels outlined in the IRP portfolio.
- **Project combinations:** Assess combinations of conceptual projects to identify additional potential benefits.
- **Feasibility Evaluation:** Continue to investigate and evaluate the feasibility of the conceptual projects considering land use, environmental impacts, permitting and costs.

Ongoing Stakeholder Engagement

PNM is committed to maintaining active collaboration with stakeholders to ensure transparency and alignment with regional planning efforts.

Stakeholders are welcome to participate in the Biannual Transmission Planning Meeting. Information regarding this meeting is posted on the PNM OASIS site (https://www.oasis.oati.com/pnm/index.html).

Stakeholders are welcome to participate in the PNM Integrated Resource Plan. Information regarding the process is posted on the PNM website (https://www.pnm.com/planning-for-the-future).

Engage with Developers

PNM encourages developers to utilize the non-tariff wires-wires or FERC Large Generator Interconnection Procedures (LGIP) to evaluate potential projects