Integrated Resource Plan:
Statement of Need Table of Contents
Working group suggestions for Public Service New Mexico - August 28, 2023

Statement of Need 17.7.3.10

- The statement of need is a description and explanation of the amount and the types of new resources, including the technical characteristics of any proposed new resources, to be procured, expressed in terms of energy or capacity, necessary to reliably meet an identified level of electricity demand in the planning horizon and to effect state policies.
- The statement of need shall not solely be based on projections of peak load. The need may be attributed to, but not limited by, incremental load growth, renewable energy customer programs, or replacement of existing resources, and may be defined in terms of meeting net capacity, providing reliability reserves, securing flexible resources, securing demand-side resources, securing renewable energy, expanding or modifying transmission or distribution grids, or securing energy storage as required to comply with resource requirements established by statute or commission decisions.

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1. Introduction

The Statement of Need [Son] is a new PRC-required section in PNM's 2023 IRP filing. The SoN provides the inputs of a self-selected group of ~250 external persons called the IRP External Advisor Group [EAG] who represent the public, governmental agencies, and parties with interest in the long term planning by PNM. PNM is a wholly owned, regulated power-generating subsidiary of the holding company PNMR that provides approximately 2,000 MW of electrical power to more than 525,000 residential and business customers in central and northern New Mexico.

The EAG has reviewed the results/recommendations of the 2023 modeling process. This SoN 2023 includes:

a) Examination of identified generation and storage resources to maintain PNM as the reliable [24/7/365] provider of low-carbon power at the least cost to its rate paying customers. See Comprehensive Table of Resources;

b) Response to PNM's preferred 2023 plan/portfolio;

c) Additional resources not included in the 2023 modeling;

d) Other considerations related to the transition from fossil fuels in PNM's power generation portfolio in the short term planning period until 2026 and the IRP twenty year planning horizon until 2043;

e) Items for Future Discussion, beyond this IRP, that the EAG identified for monitoring and possible inclusion in future PNM IRPs.

2. **Vision and Goals**
    a. The identification of a set of resources and a sequencing of those resource deployments that conforms to the regulations and policies of the State of New Mexico, reliably serves all customers at a reasonable cost with electrical energy that is that is resilient in the face of national security, technology, infrastructure, resource, cyber and environmental constraints.
    b. Goals
        i. Support Rapid Decarbonization & Electrification
        ii. Reliability and Resilience: Utility's Obligation to Serve
            1. Minimum Reserve Requirements
            2. Reliability Standards
            3. Swift recovery from climate or security threats
        iii. Public Interest and Equity
            1. Responsibilities to Ratepayers and Stakeholders
                a. Affordability
                b. Availability to Underserved Communities
                c. Climate Justice for individuals and communities impacted by plant retirements or local pollution
                d. Impacts on Workforce (e.g., transition of workers from closing coal plants, exposure to weather, etc.)
            2. Costs associated with the development and deployment of all candidate resources
                a. Costs of Energy to Consumers
                b. Life Cycle Impacts
                    i. Pollution
                    ii. Greenhouse Gas emission
                    iii. Materials
                    iv. Utility disposal
            3. Improve Communication to the General Public
                a. PNM communications with public re: change in timing on demand, how that changes system needs, and smart meter data collection and security
                b. Not In My BackYard (NIMBY) attitude regarding siting polluting resources should be reversed and clean, job and tax base creating resources, should be sited in frontline communities as well.
3. **Identified Decision Points and Pathways**
    a. "Getting to Zero" Greenhouse Gas
        i. Motivations
            1. Regulations & Policy
                a. Energy Transition Act (2019)
                b. EPA's proposed greenhouse gas emissions standards for power plants
                c. N.M. methane control rules
            2. Public service in response to March 2023 IPCC report analysis summary for policymakers
            3. Recognition of Company's corporate commitment to zero carbon by 2040
    b. Making "no regrets" Decisions
        i. Evaluation of land use and community impact

        ii. Broad Inclusion of Stakeholders
        iii. Minimizing investment risk
            1. Avoiding and minimizing stranded assets
                a. Loss of public trust
        iv. Maximizing Infrastructure Investment Opportunity
            1. First to market w/ long term solutions
            2. Public trust and sentiment
        v. Value of money vs future human life opportunities
    c. Evaluate & Pursue Regional Planning and Coordination
        i. Organized market opportunities
        ii. Future regional transmission operator (RTO) opportunities
    d. Modernizing the Grid
        i. Policy needs to support reaching carbon targets, DSM (demand side management), DG (distributed generation) and other behind-the-meter resources)
        ii. Demonstrate transition from old to new grid structure
        iii. Assessment of impact of all areas of behind-the-meter resources.

4. **Resources**
    a. Resource Description:
        i. A *brief* description of the resource; its technical characteristics.
    b. Commercial Maturity:
        i. The Technology Readiness Level (TRL) or similar metric to describe the commercial maturity of the resource. How long has it been used in electric utility applications? This criteria needs to be done carefully. Some technologies have been the brunt of sabotage, business ineptness, and smear campaigns by the opponents.
    c. Staged Cost:
        i. This is a breakdown of cost by scale (if applicable). For example, solar may have a cost for 1 MW to 5 MW; and a different cost for 10 MW to 100 MW. And for storage it should also include Return Trip Efficiency (TRE) and similar variables as are in the below table.
    d. Grid Applications and Benefits:
        i. Why is this resource important to the grid? What are its applications and benefits?
    e. Status of each resource in the modeling process (i.e., included, not included with reason why, not available for inclusion for lack of data, etc.)
    f. Candidate Resources
        i. Base technologies
            1. Wind
            2. Solar
            3. 4-hr li-ion storage
            4. Energy efficiency
            5. Demand response
        ii. Other Resources
            1. Pumped hydro storage 70-hr (NW NM)
            2. Pumped hydro storage 8-hr (NW NM)
            3. Iron-air storage
            4. Compressed Air Energy Storage
            5. Liquified Air Energy Storage

6. Flow battery
7. Thermal storage (with steam turbine)
8. Combustion Turbines
9. Linear generators
10. Carbon capture retrofit (Afton)
11. NET power plant
12. Hydrogen

5. **Potential New Resources**
    a. Adoption of new technologies
    b. High Penetration of Distributed/Customer-owned Generation
    c. Energy efficiency and demand-response
    d. Cost-effective repowering or upgrading of existing fossil resources to minimize risk of stranded investment or delayed decarbonization
    e. Describe long duration storage options not considered (reference chart 1 in “Items for Discussion” below)
6. **[System Needs]**
7. **Preferred Portfolio - Refer to appendix of resource evaluation**
    a. [results of PNM modeling]
    b. Potential pilot projects
    c. [PNM conclusions]

Items for Future Discussion

"Parking Lot"

1. General
    a. Explanation of the Integrated Resource Plan (IRP)
        i. IRP as a tool for utility's capital outlay plan
        ii. Misconceptions about the 20-year IRP window
        iii. Importance of the 3-year Action Plan
2. Existing resources and technologies
    a. End-of-life considerations
        i. Definition and examples
        ii. Resource disposal post operational life
    b. Energy Resources to consider
        i. Geothermal energy
        ii. Small Modular Reactors (SMRs)
        iii. Issues and concerns with SMRs
    c. Issues with new gas as a resource
    d. Role of Energy Efficiency in IRP
        i. PNM's current portfolio
        ii. The role of IRP
        iii. Energy efficiency measures
    e. Role of Demand Response
    f. Role of Load Management
        i. Time of use rates and dynamic rate options
        ii. Importance of different load shifting scenarios
    g. Consideration for grid improvements for Demand-Side Management (DSM)
3. PNM's programs and their impact on DSM
    a. Whole House Electric Vehicle (WHEV) rate
    b. Implications for low-income customers with smart meters
    c. Electromagnetic wave generation concerns
4. Options for the transition from carbon-based energy
    a. Inclusion of all possible resources
    b. Prioritization based on feasibility, required infrastructure, reliability, and lifecycle costs - Comment by Robert Barber
5. Comments and Concerns from stakeholders
    a. NIMBY and consumer education
    b. Impact of electrification on load forecast
    c. Incorporating wind turbine capabilities into modeling
    d. Need for more information on distribution system planning
    e. Improved data collection on outages, especially in disadvantaged areas
6. Identified Decision Points and Pathways

a. Any impact from Methane?

OUTLINE EDITS

1. 2b3: Swift recovery from climate or security threats
2. Public service in response to March 2023 IPCC report analysis https://www.ipcc.ch/report/ar6/syr/ summary for policymakers - pg 23
3. Modernizing the Grid
4. 3e: Assessment of impact of all areas of behind-the-meter resources

(1) There are numerous technologies within Long Duration Storage

NON-EXHAUSTIVE – HYDROGEN AND HYBRID LONG DURATION STORAGE EXCLUDED

Less Desirable — More Desirable

Faces geologic constraints[1] | Not enough public datapoints to obtain a reliable value | Inter-day | Can function as both | Multi-day / week

Duration	Energy storage form	Technology	Nominal duration, hrs	LCOS[5], $/MWh	Min. deployment size, MW	Average RTE[1], %	TRL
Inter-day	Mechanical	Traditional pumped hydro (PSH)	0–15	70–170	200 – 400	70–80	9
		Novel pumped hydro (PSH)	0–15	70–170	10–100	50–80	5-8
		Gravity-based	0–15	90–120	20–1,000	70–90	6-8
		Compressed air (CAES)	6–24	80–150	200–500	40–70	7-9
		Liquid air (LAES)[1]	10–25	175–300	50–100	40–70	6-9
		Liquid CO2[1]	4–24	50–60	10–500	70–80	4-6
Multi-day / week	Thermal	Sensible heat (e.g., molten salts, rock material, concrete)[2]	10-200[2]	300	10–500	55–90	6-9
		Latent heat (e.g., aluminum alloy)	25–100	300	10–100	20–50	3-5
		Thermochemical heat (e.g., zeolites, silica gel)	XX	XX	XX	XX	XX
	Electrochemical	Aqueous electrolyte flow batteries	25–100	100-140	10–100	50–80	4-9
		Metal anode batteries	50–200	100	10–100	40–70	4-9
		Hybrid flow battery, with liquid electrolyte and metal anode (some are Inter-day)[2,3]	8–50[2]	XX	>100	55–75	4-9

1 Demand potential / market size is limited by the requirement for specific geological formations
2 Codified based on primary technology type
3 Can function as inter-day, but organized based on longest duration potential
4 Some flow batteries under development will not work for multi-day, but it is categorized here as such given the technology's maximum duration

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Source: Adapted from LDES Council Net-Zero Power Report 2021, Wood Mackenzie Long Duration Energy Storage Report 2022, Company websites, Academic research