Integrated Resource Plan:
Statement of Need Table of Contents
Working group suggestions for Public Service New Mexico - May 31, 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.

Table of Contents

1. Introduction
    a. The PNM Integrated Resource Plan 2023 provides a comprehensive long range path for building out the strongest, most reliable electrical power delivery system for our customers over the next 20 years as we can envision. The IRP report begins with the current status of PNM's system, and shows how available resources and technologies can bring improvements. Simultaneously we recognize that changes are occurring in nearly every sector of the environment in which we operate. These will require ongoing re-evaluation and modifications to the 2023 IRP plan that will be incorporated in future triennial PNM IRPs.

    Meeting our clean energy goals and preserving system reliability, while providing for the growing needs of our customers in an affordable manner, will require the addition of significant amounts of new generation capacity over the next twenty years. We anticipate that between today and 2040, the likely amount of new installed generation capacity will total between 4,000 to 5,000 MW or more. This amount of *new* capacity is significantly greater than the amount that exists today, implying that the achievement of our goals will require continuous and significant evolution of our portfolio.

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. Regulatory Environment and Requirements
        i. Legal requirements and standards in planning horizon
            1. Energy Transition Act
                a. Renewable Energy Act / Renewable Portfolio Standard
                    i. 80% renewable by 2040 and 100% carbon-free by 2045
                b. Status of plant abandonment and replacement power
            2. Efficient Use of Energy Act
                a. Energy efficiency and load management goals starting in 2025/6

3. EPA GHG Standards for fossil-fueld power plants
    a. Proposed 5/23/23, may take 1 year or longer to finalize
    b. Starting in 2030, the proposed requirements vary by the type of unit (new or existing, combustion turbine or utility boiler, coal-fired or natural gas-fired), how frequently it operates, and its operating horizon (i.e., planned operation after certain future dates).
4. EPA Good Neighbor Plan
    a. NOx emissions trading regime for power plants in 22 states
    b. March 15, 2023 plan did not include New Mexico but said "EPA's updated modeling analysis for 2023 suggests that the states of Arizona, Iowa, Kansas, and New Mexico, may be significantly contributing to nonattainment or maintenance in downwind sites. EPA intends to undertake additional assessment of its modeling for these states and will determine if it is necessary to address Good Neighbor obligations for these states in future action(s)."
    c.

ii. Known and expected rules
1. NM Stat § 62-17-10 (2018)
2. NM Administrative Code 17.7.3
3. Case #21-00128-UT Final Order
    a. Substantial revisions to NMAC 17.7.3 IRP planning rule, of which this Statement of Need is a part.
        i. IRP filing and content requirements
        ii. description of existing resources,(2) current load forecast, (3) load and resources table, (4) identification of resource options, (5) statement of need, (6) determination of the resource portfolio, and (7) action plan,
        iii. Facilitated Stakeholder Process; IRP Process
        iv. Statement of Need
        v. Action Plan
            1. June 2 PRC letter re: Action Plan period and planning horizon
        vi. Request for Proposals Process, Cost recovery, Independent Monitor, Variances and Amendments
4. Case #21-00033-UT(PNM 2021 IRP) Final Order
    a. "23. For this reason, the Commission finds that PNM should include, in its future 2023 IRP filing a meaningful analysis of transmission and distribution constraints and opportunities to increase resource availability and flexibility."
    b. Additional requirements/orders added since #21-00128-UT Final Order?

c. Goals

i. Reliability and Resiliency: Utility's Obligation to Serve
1. Minimum Reserve Requirements
2. Reliability Standards
3. Swift recovery from climate or cyber disruption

ii. Public Interest and Equity

1. Responsibilities to Ratepayers and Shareholders
    a. Affordability
    b. Availability to Underserved Communities
    c. Climate Justice for individuals and communities impacted by plant retirements or local pollution
2. Costs associated with the development and deployment of all candidate resources
    a. Costs of Energy to Consumers
    b. Climate Change Impacts
    c. End of Life (Recycling/disposal)
3. Consumer Education
4. NIMBY

3. Current and Expected System Conditions
    a. Timeline
        i. Urgency (What is driving the urgency?)
    b. Load Forecast
        i. Electrification Impact
    c. Baseline System
        i. Forecasted Retirements
        ii. Transmission Constraints
        iii. Distribution System Constraints
4. Identified Decision Points and Pathways
    a. "Getting to Zero" Carbon
        i. Motivations
            1. Regulations & Policy
                a. ETA (2019)
                    i. EPA - evolving
            2. Public Service in response to Mar 2023 IPCC report analysis - https://www.ipcc.ch/report/ar6/syr/ summary for policymakers - pg 23
    b. Making "no regrets" decisions
        i. Minimizing investment risk
            1. Stranded assets
                a. Loss of public trust
        ii. Maximizing investment opportunity
            1. First to market w/ long term solutions
            2. Public trust and sentiment
        iii. Value of money vs future human life opportunities
    c. c. Regional Planning and Coordination
        i. Organized Market Opportunities
        ii. Future Regional Transmission Operator
5. Resources

Resource Description:

A *brief* description of the resource; its technical characteristics.

Commercial Maturity:

The TRL level 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.

Staged Cost:

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 RTE and similar variables as are in the below table.

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 (XX) | Inter-day | Can function as both | Multi-day / week

Duration	Energy storage form	Technology	Nominal duration, hrs	LCOS[4], $/MWh	Min. deployment size, MW	Average RTE[4], %	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[3]	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[3]	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

U.S. DEPARTMENT OF ENERGY 4

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

Grid Applications and Benefits:

Why is this resource important to the grid? What are its applications and benefits?

End of Life: From an Environmental engineering perspective, the proper heading should be "Life-Cycle Impacts"

And the Sub headings should be: 1) Greenhouse Gas emissions 2)Materials 3)Utility Disposal

- Candidate Resources
  - Renewable generation
    - Solar (including community solar)
    - Wind
    - Geothermal
- No new gas of any type
- Energy Storage
  - Short duration (up to 10 hr)
    - Lithium-ion battery etc. see below charts
  - Inter-day & Multi-day/week Long Duration Energy Storage (LDES) - see charts below ● Seasonal Shifting
    - Pumped-hydro storage, thermal energy storage, etc

- Not for electric
- Potential New Resources
    - Adoption of new technologies
    - High Penetration of Distributed/Customer-owned Generation
    - Firming Plans
    - Energy efficiency and demand-response
    - Cost-effective repowering or upgrading of existing fossil resources to minimize risk of stranded investment or delayed decarbonization
- [System Needs]
- Preferred Portfolio
    - [results of PNM modeling]
    - Potential pilot projects
    - [PNM conclusions]

DETERMINATION OF THE RESOURCE PORTFOLIO:

A. To identify the most cost-effective resource portfolio, utilities shall evaluate all supply- side resources, energy
storage, and demand-side resource options on a consistent and comparable basis, taking into consideration risk and uncertainty, including but not limited to financial, competitive, operational, fuel supply, price volatility, downstream impacts on transmission and distribution investments, extreme-weather events, and anticipated environmental regulation costs.

B. The utility shall evaluate the cost of each resource through its projected life with a life-cycle or similar analysis.

C. The utility shall consider and describe ways to mitigate ratepayer risk.

D. Each electric utility shall provide a summary of how the following factors were considered in, or affected, the development of resource portfolios:

(1) load management or modification and energy efficiency requirements;
(2) renewable energy portfolio requirements;
(3) existing and anticipated environmental laws and regulations, and, if determined by the commission, the
standardized cost of carbon emissions;
(4) fuel diversity;
(5) susceptibility to fuel interdependencies;
(6) transmission or distribution constraints; and
(7) system reliability and planning reserve margin requirements.

E. Alternative portfolios. In addition to the detailed description of what the utility determines to be the most cost-effective resource portfolio, the utility shall develop alternative portfolios by altering risk assumptions and other parameters developed by the utility.

****

PARKING LOT

What describes end-of-life? For example, batteries may have an end-of-life when they can deliver only 70% of their nameplate capacity.

How is the resource disposed of at the end of its operational life?
Two resources that need to be included are Geothermal and Small Modular Reactors (SMR)>Small Modular Reactors go against the ETA requirement that 100% of IOU generation sources be renewable by…2045 or 2050. NM has been abused by the nuclear industry from cradle to grave. In addition, Germany has rightly retired its last 3 nuclear power plants this year recalling that 3 generations of use is now resulting in 30,000 generations of oversight of its waste. No thank you.

And again any new gas must be excluded. Methane is 85x more potent GHG than CO_2 over 20 yrs, but because it exits the cycle within 12 yrs, it should be counted in the short term as 150-200x more potent.

Energy Efficiency

- PNM already offers a robust energy efficiency portfolio.
  - o The IRP should reflect that existing effort, likely as a load forecast modifier. However, there is incremental energy efficiency to gain in PNM's territory.
- PNM has developed bundles of energy efficiency measures which can be selected by the IRP models.
  - oThese bundles are quite comprehensive but additional details are needed around cost assumptions and omitted technologies.
  - oPNM should provide insight into the energy efficiency IRP selections by sector, technology, and cost.

Demand Response

- Another DSM area in which PNM has existing resources.
- This should be taken into account in the load forecast.
- PNM should identify new, incremental demand response that can be selected as a resource in the IRP model.

Load management

- Include time of use rates and other dynamic rate options.
- Should be modeled in any IRP efforts.
- A well-designed dynamic rate can change the load profile of customers and therefore the resources needed to meet demand in any given hour or day of the year.
- Different load shifting and adoption scenarios should be run

What are grid improvements needed for DSM to be quantifiably be included in the IRP? ● Assuming PNM receives approval in case 22-00058-UT, then the grid improvements needed to measure DSM impacts for accurate quantification will be coming online over the next few years. ● PNM does not have the visibility in the existing grid to effectively use DSM as a time and location based resource at this time.

How will PNM's programs such as Whole House Electric Vehicle (WHEV) rate impact DSM?

Will low-income customers get price incentives with smart meters?[1] And you should make the program voluntary, as there are real concerns for increased electromagnetic wave generation. Beyond the IRP discussion in my opinion. These issues are better for the energy efficiency filing.