Expansion Planning Tool Development & Analysis for Energy Storage & Decarbonization with the Public Service Company of New Mexico

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Project Motivation
Collaborate with the Public Service Company of New Mexico (PNM) on their integrated resource plan (IRP) process by independently evaluating least-cost investment portfolios that meet the Energy Transition Act (ETA) requirements and evaluate the system's future energy storage requirements.

Project Objectives

**Planning Framework Development**
- Develop planning framework to evaluate energy storage technologies to meet decarbonization and renewable energy goals

**Data & Tool Development**
- Wind and Solar resource potential and ramp rate characterization in New Mexico
- Long-term power system expansion planning models
- Production cost models
- Resource adequacy
- Resilience analysis

New Mexico Energy Transition Act

- **Key components of the NM ETA [1]**:
  - Transition away from coal-fired generation to lower carbon resources
  - Increase the state's renewable portfolio standard (RPS):
    - 50% by 2030
    - 80% by 2040
  - Emission-free generation portfolio by 2045
  - PNM has promised to meet this goal by 2040

PNM Power System

**PNM Zonal Model**
- Figure showing PNM Zonal Model
- Existing PNM Resources

Proposed Planning Framework & Tool Development

Current efforts include developing framework to identify how planning should be coordinated effectively to meet decarbonization goals and to enhance decision making process about future resource mix.

**Summary of ongoing tool development**

- **Long-term Expansion Planning Model**
  - Seeks to identify least cost resource and transmission investments over long-term planning horizon (20yrs).
  - Temporal and spatial scales are often aggregated to reduce computational complexity.

- **Resource Adequacy**
  - Ensures the resource mix determined by the IRP module guarantees reliable power generation and tracks dynamic changes in the state-of-charge of the energy storage devices.

- **Operational/Performance Analysis**
  - Includes a failure mode and effects analysis (FMEA) of the energy storage and transmission systems to highlight potential for long duration energy storage technologies.

- **Stakeholder-Driven Systems Dynamics Tool**
  - Incorporates stakeholder feedback and additional constraints to evaluate least-cost investment portfolios. Identifies potential sensitivities to incorporate in planning process. This work is in coordination with "Systems Dynamics Modeling for Regulators" project led by Howard Passell.

Variable Generation Forecast Error and Required Regulating Reserves

- 5-minute data for solar and wind used
- Forecast error for each 5-min period in the year was calculated
- Full analysis provided in [2]

Energy Storage Modeling in Planning Tools

- Current expansion planning tools do not capture the full operational benefits of energy storage technologies due to the aggregation of temporal scales. Time buckets are typically created based on load by season and time of day.
- Temporal and spatial scope has an impact on the investment decisions of energy storage technologies. Including times when there is inadequate renewable energy available into the planning models will provide insight into how much and what type of energy storage of are required.

Future Work & Research Gaps to Address

- Incorporate transmission system and identify potential transmission investments and regional diversity of wind and solar.
- Evaluate long-term energy storage technologies by incorporating various time scales into the planning models.
- Explore options how to better coordinate tools that are under development to identify the best approach to evaluate energy storage technologies.

References