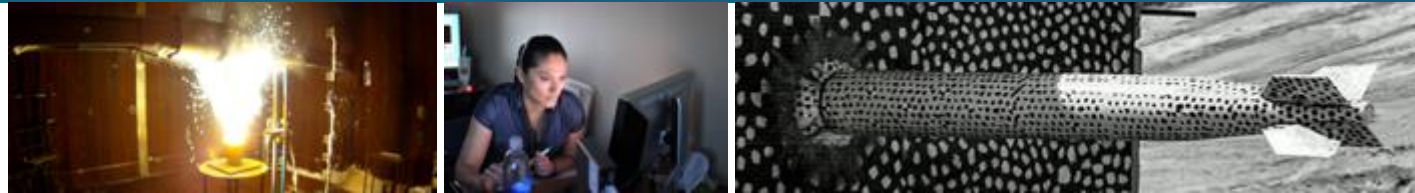


SNL CRADA- Public Service Company of New Mexico (PNM)



PRESENTED BY

Jim Ellison, Cody Newlun, and Andrew Benson

DOE Energy Storage Peer Review - October 2021

Overview of Project Goals

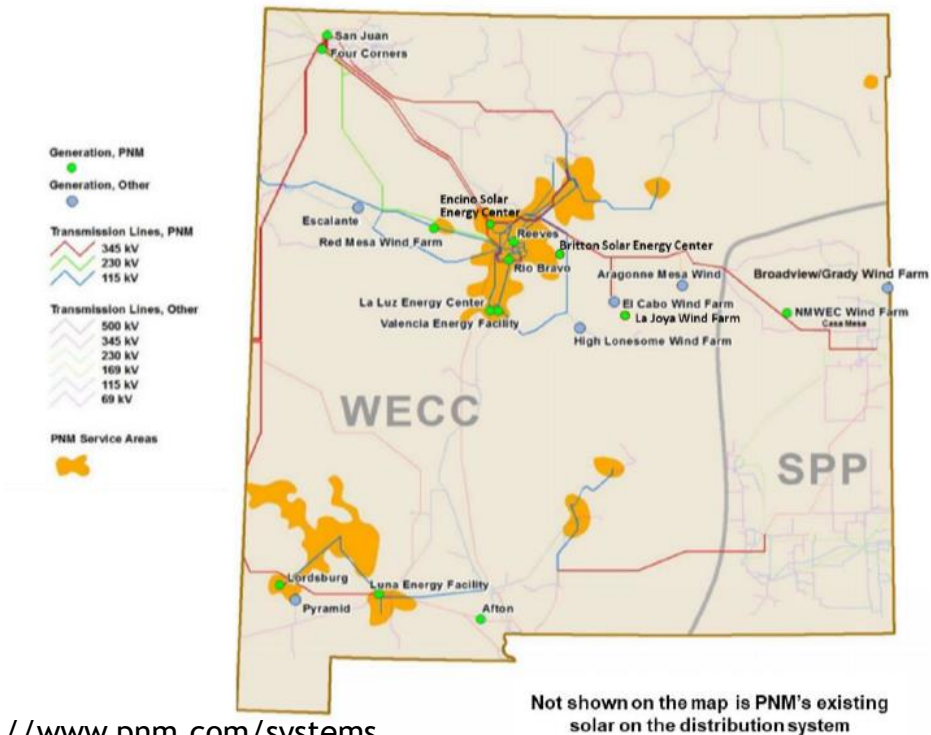


- ❖ **Objective:** develop optimization algorithms and tools to identify least cost options for meeting PNM's reliability requirements with 100% clean generation in 2040. Special attention will be placed on properly evaluating the role of energy storage in future generation portfolios.
 - ❖ These tools will then be applied to several case studies.
- ❖ **Stage 1:**
 - ❖ Develop PNM generation and transmission dataset for use in study
 - ❖ Characterize ramp rates of variable generation
 - ❖ Specify formula for regulating reserve based on renewable output
- ❖ **Stage 2:**
 - ❖ Conduct expansion planning exercise to determine optimal resource investment portfolios
 - ❖ Represent transmission system
 - ❖ Evaluate alternative resources not fully covered in the PNM IRP process and what role (if any) they could play in PNM's future electricity grid
 - ❖ Test for feasibility in challenging years using production cost model
- ❖ **Stage 3:**
 - ❖ Develop production cost model with an emphasis on representing energy storage technologies
 - ❖ Include expansion planning functionalities
 - ❖ Evaluate several planning scenarios and explore stochastic programming features
- ❖ Project Duration – five years, with about four years remaining

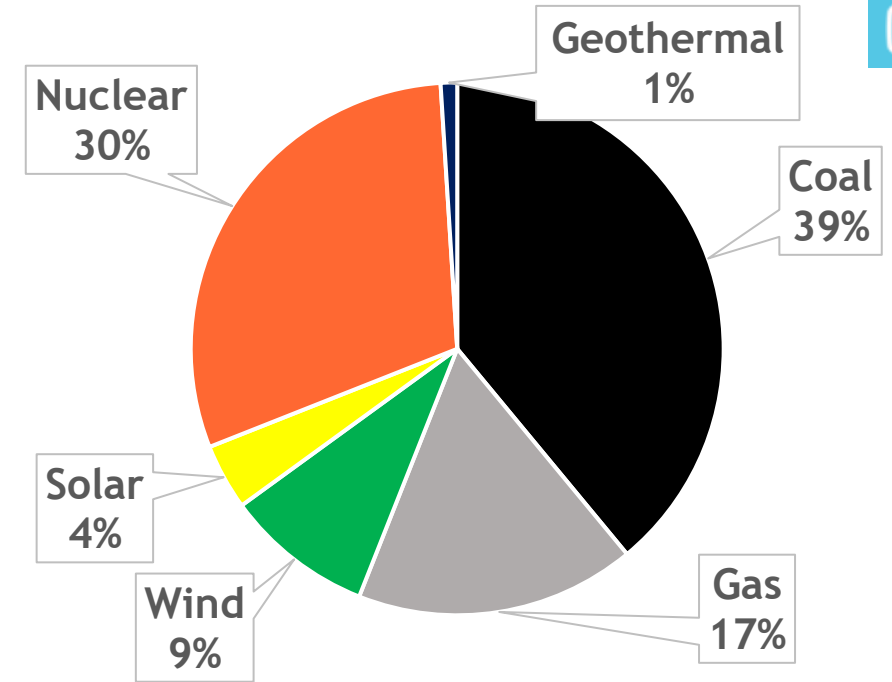
About Public Service Company of New Mexico (PNM)

- ❖ PNM System:
 - ❖ Services approx. **530k customers**
 - ❖ Total installed capacity ~**2865 MW** [1]
 - ❖ Coincident system peak: ~**1,674 MW**
- ❖ NM Energy Transition Act (ETA) goals for investor-owned utilities:
 - ❖ **80% Renewable Portfolio Standard** by 2040
 - ❖ **100% carbon-free generation** by 2045
 - ❖ PNM has volunteered to achieve the zero-carbon resource standard by 2040

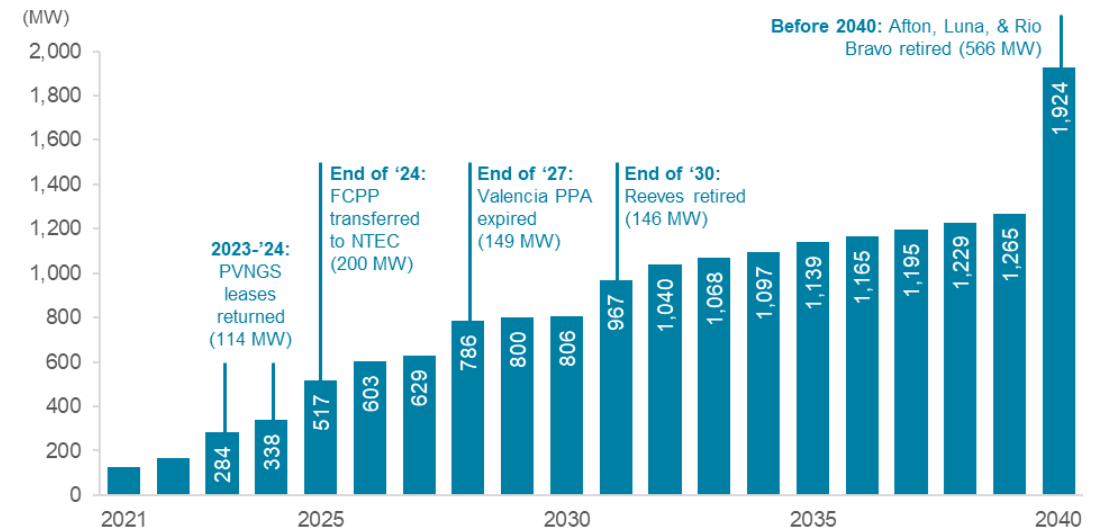
PNM Service Territory [2]



PNM Generation Mix [2]



Future PNM capacity needs [2]



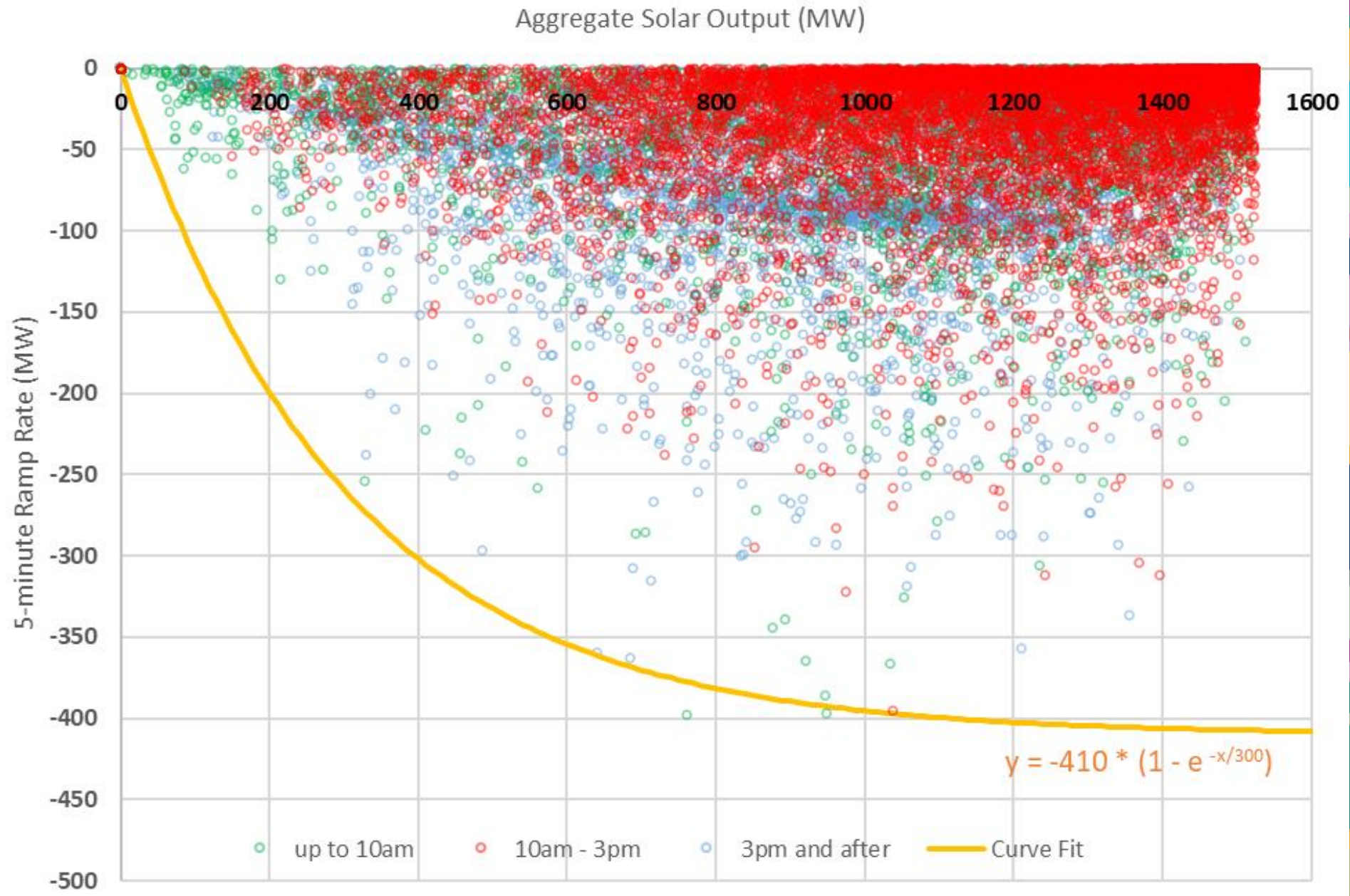
[1] <https://www.pnm.com/systems>

[2] <https://www.pnmforwardtogether.com/assets/uploads/PNM-2020-IRP-FULL-PLAN-NEW-COVER.pdf>

4 Ramp Rate Analysis



- ❖ Goal of ramp rate analysis:
 - ❖ Analyze solar and wind variability
 - ❖ Inform the level of spinning reserve necessary at a given level of solar and wind output
- ❖ This figure shows 5-minute solar downward ramps
 - ❖ based on 5-minute weather data from 2019



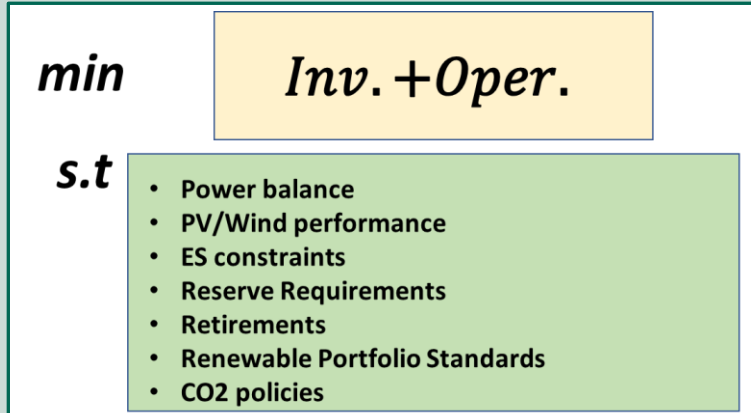
Expansion Planning & Production Cost Simulations

5



Expansion planning model

- Identifies optimal investment plan



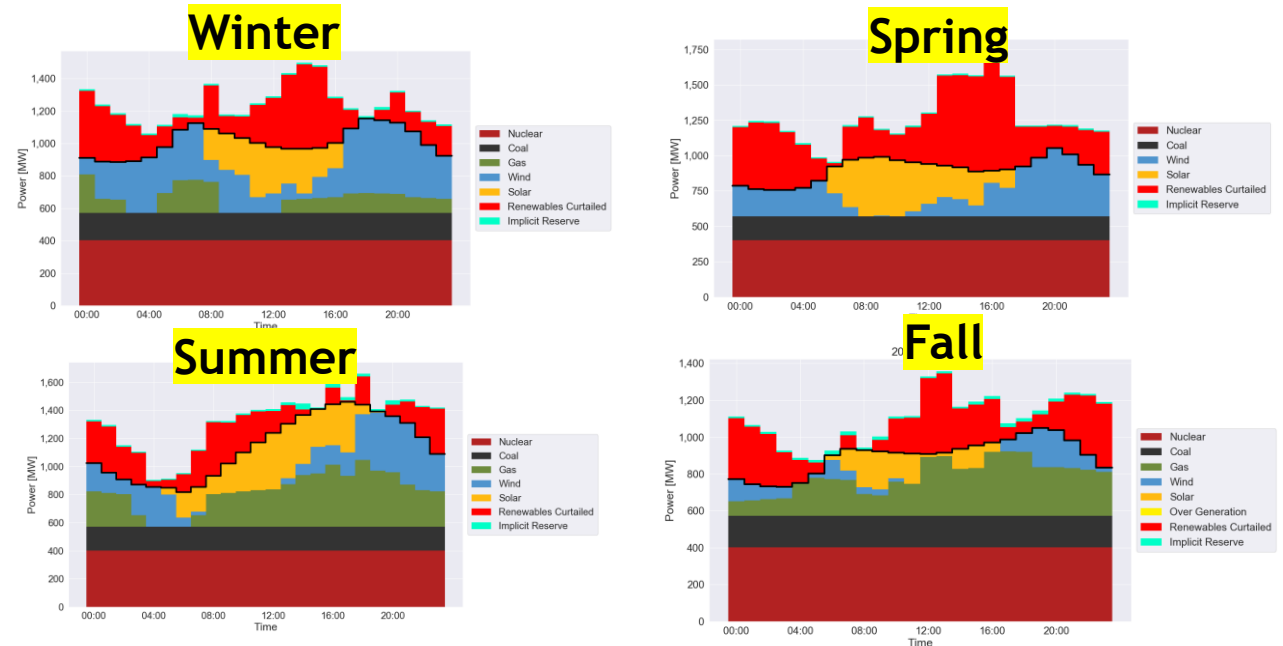
- Simulates typical operating conditions+peak
- PNM uses EnCompass software [3]

Production cost simulation

- Simulates the operations for a typical year (8760 hours)
- Minimizes costs while solving the security constrained unit commitment and economic dispatch
- PNM uses EnCompass software [3]
- Sandia; pyomo-based tools Prescient [4] and EGRET [5]

Output [2]

- Investment portfolio: future generation mix (installed and firm capacity)
- Investment costs
- Fixed costs
- Role of storage technologies in future generation mix



Sample PNM generation dispatch for a select day in each season. Generated from Prescient [4].

[3] <https://anchor-power.com/encompass-power-planning-software/>

[4] <https://github.com/grid-parity-exchange/Prescient>

[5] <https://github.com/grid-parity-exchange/Egret>