Generation and Transmission System Overview

RADIOACTIVE AND HAZARDOUS MATERIALS COMMITTEE

November 23, 2010

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Agenda

- Transmission Grids
- System Map Overview
- A Few Facts…
- PNM Transmission System Uses
- System Representation
- Load Characteristics and Load Growth
- Existing Queues
- Transmission Development Issues
- Renewable Resources and Wind Energy Potential in NM
Three Transmission/Grids Exist In The US
The Western Transmission Grid
Covers the 14 western United States and parts of Canada and Mexico

- 7 HVDC (asynchronous) interconnections between Eastern and Western Grids - 1470 MW
- 2 HVDC interconnections between Eastern grid and ERCOT - 820 MW
- No interconnections between Western grid and ERCOT
• Lines shown in red are the primary backbone transmission lines in NM

• The main function of transmission is to deliver power from generating resources to load centers

• Lower voltage lines serve as backup to the backbone lines and to distribute power to outlying smaller load areas distant from Albuquerque and El Paso
A Few System Facts……

Line mileage (incl. jointly owned lines)

- 165 miles of 500 kV (Outlet lines from Palo Verde)
- 1556 miles of 345 kV
- 180 miles of 230 kV
- 1000 miles of 115 kV

“Backbone” transmission lines (345 kV and 230 kV) are 150 to 200 miles in length.

Majority of transmission lines built in late 1960s through the mid 1970s.

PNM has not built any backbone transmission since 1984.
PNM Transmission System Uses

PNM Balancing Authority Load

- Retail-PNM customers represent about 60% to 65% of system use
- Wholesale-Transmission customers (network customers and P-to-P) represent 35% to 40% of system use
System Representation

Peak Load

WECC
11.1% of Generation

Four Corners
43.3% of Generation
3% of Load

North/Central NM
18.6% of Generation
87% of Load

Southern NM
20.7% of Generation
10% of Load

SPP
6.3% of Generation
Load Characteristics and Load Growth
PNM System Load

Peak Load
- Home ~4000 watts or 4kw or 0.004MW
- 300 residential homes ~1MW
- Cottonwood Mall ~5.5MW

System peak load is during Summer
- Winter peak ~90% of Summer
- Winter Peaking areas in Northeastern NM
Existing Queues

Interconnection Requests

- 41 -- 14,143 MW (12,870 MW wind & 1,273 MW solar)
- 4 -- 1075 MW Pending LGIA
- 8 -- 635 MW Signed LGIA not operational (gas, wind, solar)
- 4 -- 492 MW Operational (December 2010)

Joint Studies (EPE/TSGT)

- 8,416 MW

Transmission Delivery Service Requests

- 65 -- 8410 MW
- 4 -- 297 MW Signed TSA not operational

Peak Load

- 1,973 MW (PNM)
- ~2,600 MW (PNM Balancing Authority)
- ~5,000 MW Total New Mexico
Transmission Development Issues

- Few PPAs are being inked, projects are very slow to move forward with signed agreements
- Transmission lacking in renewable rich zones
- Congestion/ lack of transmission between NM-AZ and AZ-CA
- Transmission is a regional issue—All stakeholders in the region need to cooperate in solution
- Transmission very expensive—can’t be justified for single use
- Transmission siting is lengthy and difficult—large costs at risk on front end
- Determining who pays and how costs are recovered for long distance lines is very difficult
- Collaboration needs to begin at the federal/state level to address conflicting goals of governments. Federal and state policies are not aiming at the same targets.
Renewable Resources and Wind Energy Potential in NM
Renewable Portfolio Standards

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- Renewable portfolio standard
- Renewable portfolio goal
- Solar water heating eligible

- 29 states + DC and PR have an RPS
  (7 states have goals)

2010

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Minimum solar or customer-sited requirement
* Extra credit for solar or customer-sited renewables
† Includes non-renewable alternative resources
Regional Diversity of Renewable Resource Opportunities

Concentrating Solar Resource at the United States

Wind Resource (50m) at the United States

Biomass Resources of the United States Total Resources by County

Geothermal Resources at the United States
Typical Cost to Install Wind and Solar (PV) 100 MW plant

Wind ~$235 Million
   Land owner ~$3k to $5k per turbine/year

Solar (PV) ~$450 Million

Solar-Thermal (storage) ~$610 Million
Larger, Water-bound

Evolution of U.S. Commercial Wind Technology

The 1980's
- Altamont Pass, CA
  - Kenetech 56-100kW

The 1990's
- Altamont Pass, CA
  - Zond Z-750kW
- Buffalo Ridge, MN
  - 750kW
- 500kW

2000 & Beyond
- Hagerman, ID
  - GE 1.5 MW
- Arklow, Scotland
  - GE 3.6 MW
- Offshore
  - 5 MW
- Land Based
  - 3.6 MW
- 2.5 MW
- Medicine Bow, WY
  - Clipper 2.5MW
  - 93m blade

The power to make life better. Together.
Wind Energy Potential in NM

Map by created by TrueWind Solutions from MesoMap system using historical weather data.
Existing Wind Generation in New Mexico

**Installed: 698 MW**

- 80 MW “Caprock” near Tucumcari, Cielo Wind, PNM (2005)
- 120 MW “San Juan Mesa Wind Project” near Elida, Padoma Wind Power, SPS (2005)
- 90 MW “Aragonne Mesa” Superior Wind, west of Santa Rosa, APS (2005)
- 100 MW “High Lonesome Mesa” Edison Mission, near Willard, APS (2009)
New Mexico Wind Energy Center

- Located in Eastern New Mexico
- 204 MW capacity
- Installed in 2003, in record time!
- Owned and operated by FPL Energy (NextEra)
- PNM purchases all the output
Quick Fact: The bottom tower section has a base 16-foot diameter and weighs 39 tons.
Tower Erection - 2nd Tower Section
Placing the Generator
235 feet Diameter Blade Assembly
Flying The Rotor

Quick Fact:
The rotor and 3 blades weigh 43 tons.

Quick Fact:
The 275-ton crane’s boom is 300 ft long.
Installing the Rotor
All 136 Turbines Erected!

Quick Fact:
It is 310 feet to top of blade
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PNM Load (08/03-08/04)

- Winter Peak Load
- Spring/Fall Load Valleys
- Summer Peak Load
NMWEC Output Pattern (08/03-08/04)

- Winter Peak Load
- Spring/Fall Load Valleys
- Summer Peak Load
Questions?