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Challenges of Coal Generation

Advanced Coal Generation, Carbon Capture & Sequestration
– A Utility Perspective

EPA Advanced Coal Technology Work Group Meeting

Hilton Santa Fe, New Mexico

August 7, 2007

Greg Nelson – Director, Advanced Generation Development

Topics to Discuss

- Background on PNM
- Challenges facing PNM
- Actions being taken by PNM
- Advanced Coal Generation and Carbon Capture & Sequestration
- Questions

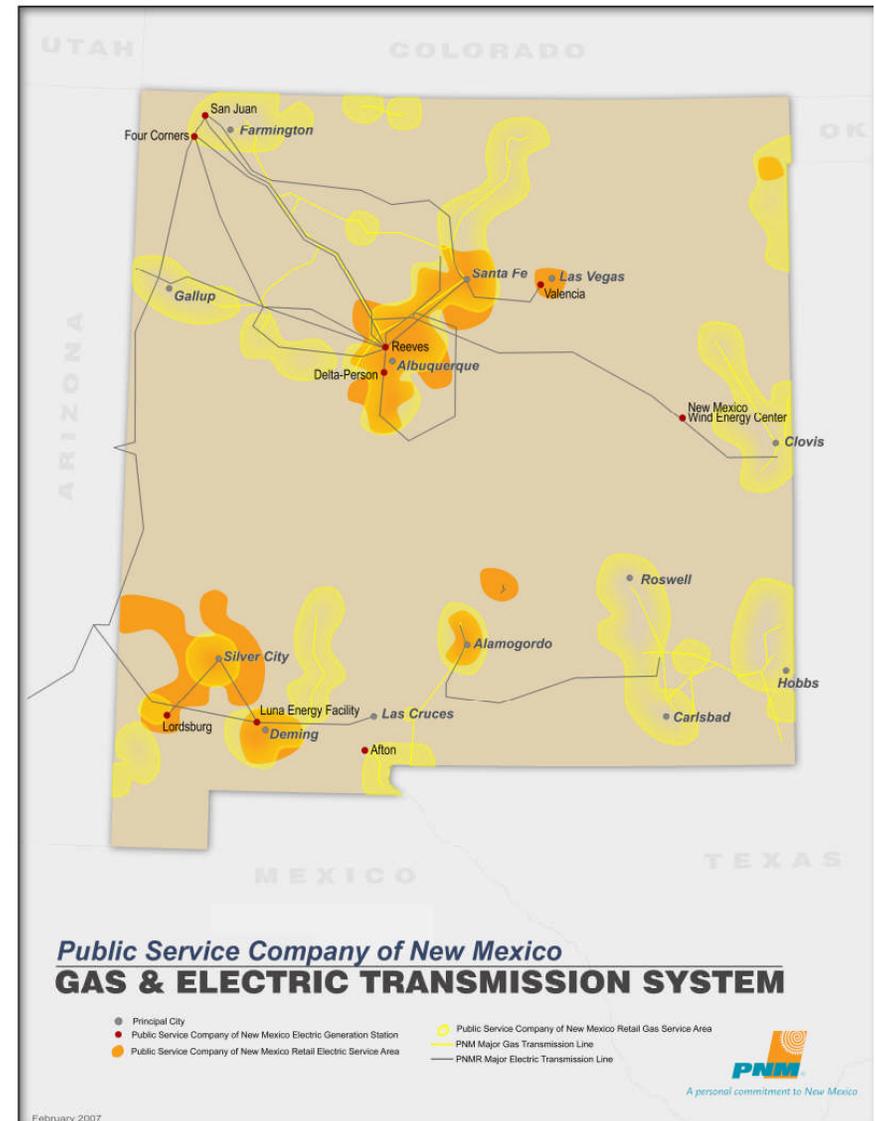


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Background on PNM

PNM's Energy Resources

- Ownership in two coal-fired plants
 - San Juan Generating Station
 - Four Corners Power Plant
- Own and operate gas-fired plants
 - Afton Generating Station
 - Reeves Generating Station
 - Lordsburg Generating Station
 - Luna Energy Facility
- Ownership in nuclear power
 - Palo Verde Nuclear Generating Station Units 1, 2 & 3 (AZ)
- Purchased power
 - NM Wind Energy Center
 - Delta Station



Electric Prices

➤ **PNM Electric Rates**

- 25% below the regional average
- 18% below the national average
- Rates frozen until '08 regardless of the cost of producing power
- Residential rates same as they were in '82
- 4 rate reductions since '94
- New rate case filed in early 2007



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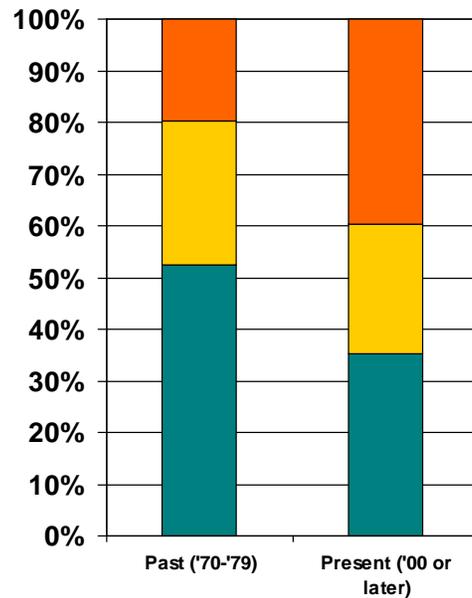
Challenges Facing PNM

Increased Customer Demand

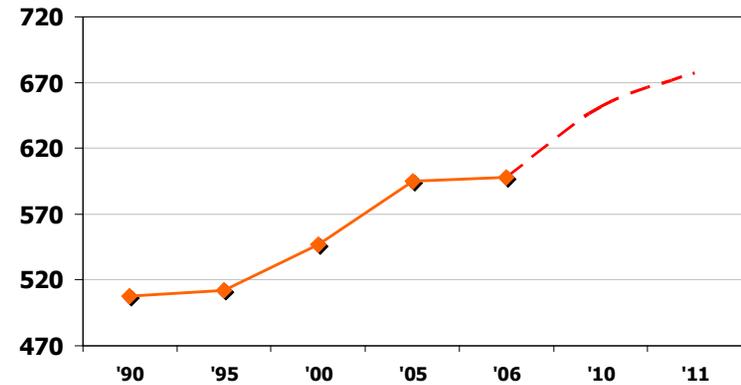
- **Present State of the Electric Utility Industry**
 - Americans use 21% more electricity than they did in 1978
 - Electricity consumption is expected to increase by at least 40% by 2030
 - Industry will spend approximately \$412 billion to meet increased demand
 - Building cycle for new generation, transmission and distribution

Changes in Customer Lifestyle

PNM Customer Usage Increasing



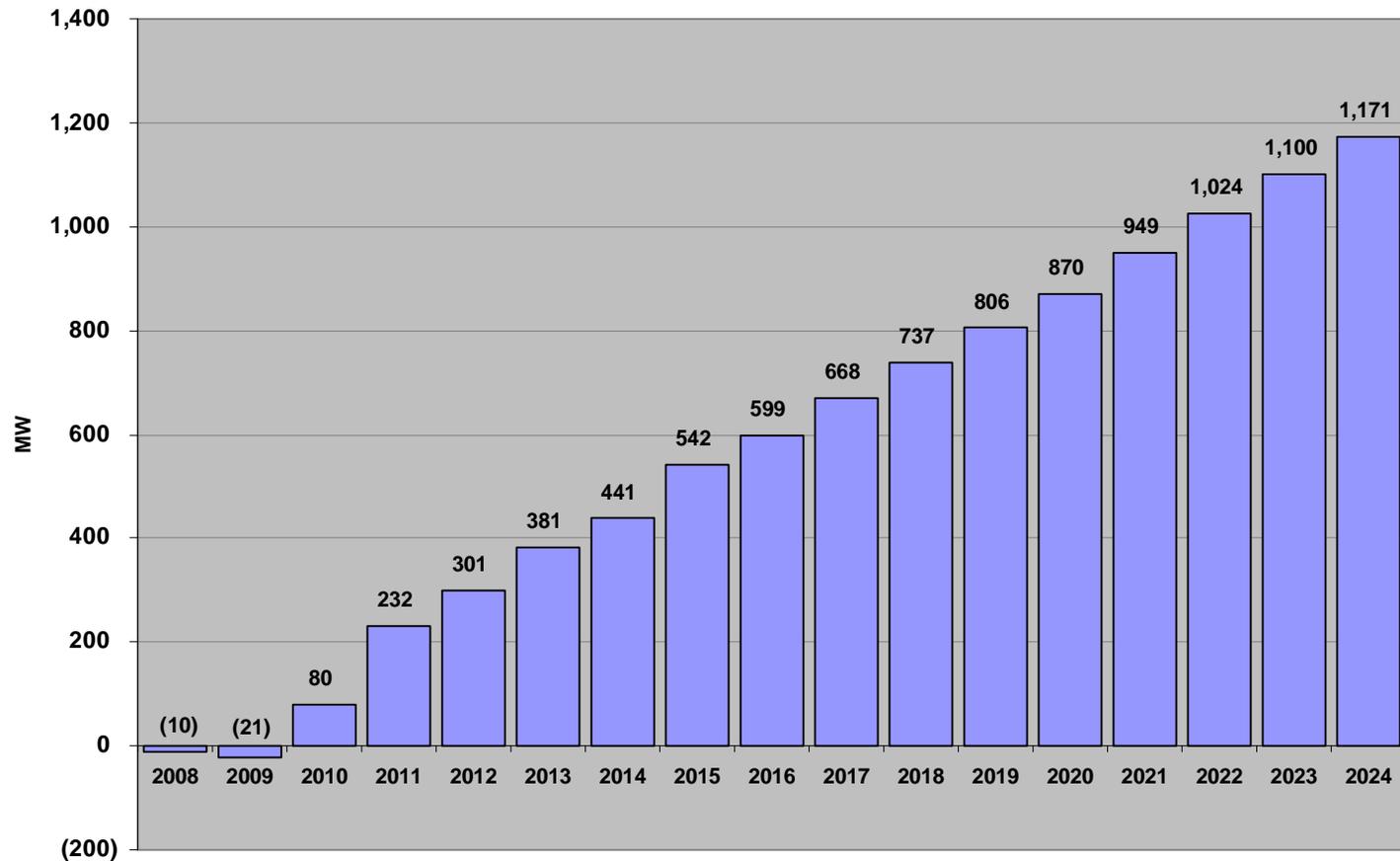
- Large houses (2401 sq ft or more)
- Mid size houses (1801 - 2400 sq ft)
- Small houses (1200 sq ft or less)





Meeting Increased Customer Demand

PNM's Future Resource Needs

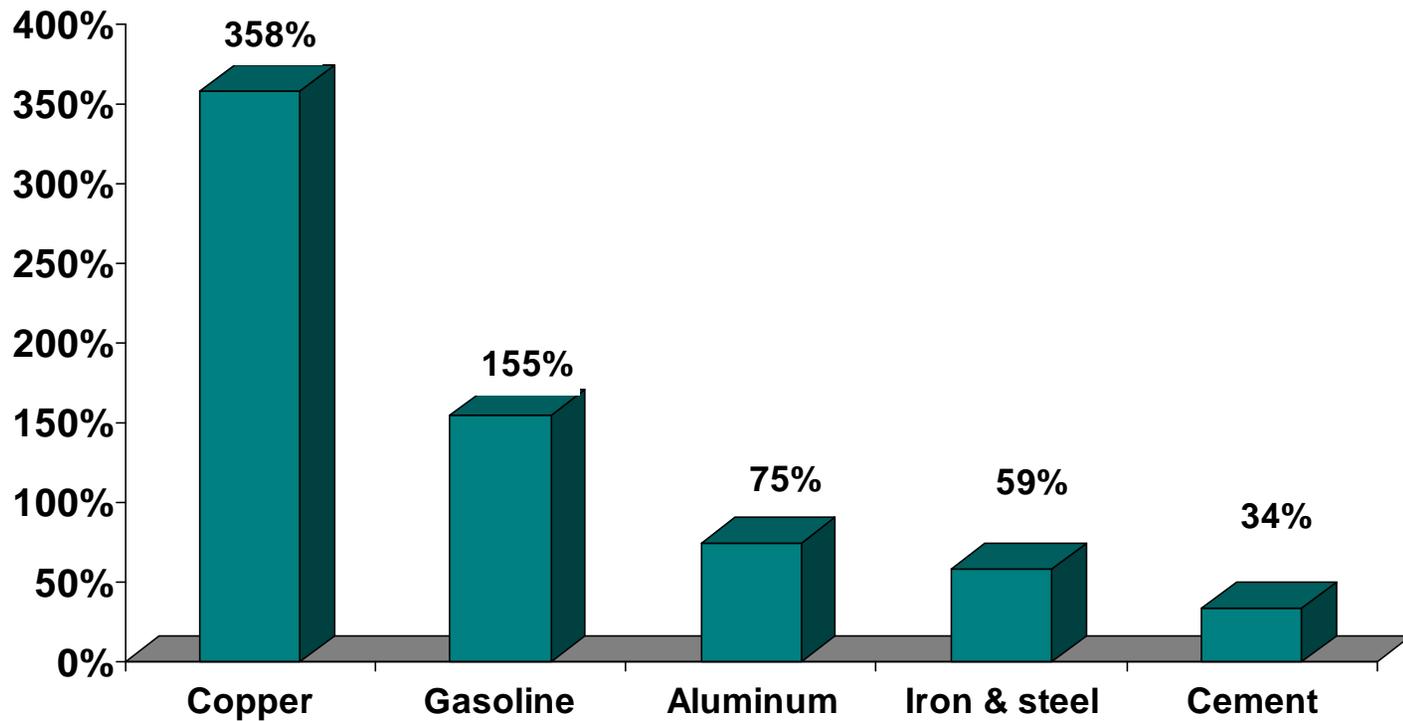


Average system growth of 3 to 4 percent a year



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Basic Utility Building Blocks on the Rise



U.S. Department of Labor --
Comparison of 2002 costs to 2006

Striking a Balance

- Reliable and affordable electricity is key
- Producing electricity has environmental consequences
- Challenge is to achieve a balance by reducing our environmental impact while keeping energy prices affordable



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Actions being taken by PNM

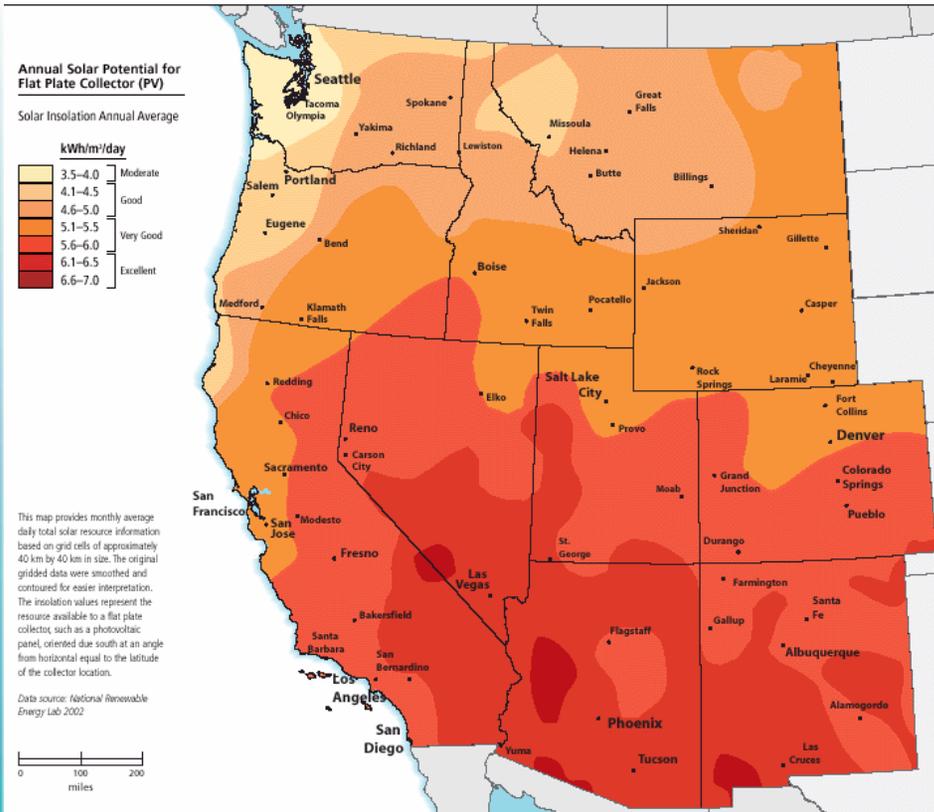
Clean Energy Resources

➤ PNM Clean Energy Resources

- 204-megawatt NM Wind Energy Center
- 25 kW solar photovoltaic generation
- Incentives for customer-owned solar photovoltaic systems
- Agreement for 32 megawatt biomass plant
- Concentrating solar study in NM
- Emissions upgrade at San Juan Generating Station



Western Solar Potential



Source: Western Resource Advocates



Energy Efficiency

- **Energy Efficiency**
 - Least expensive and cleanest resource for the future
 - Western Governor's Association goal of 20% by 2020

- **PNM Electric Energy Efficiency Plan**
 - Proposing nine measures that would:
 - Promote electric energy efficiency to reduce amount of electricity consumed
 - Manage demand for energy to free up electricity during peak demand times
 - Estimates that programs could result in energy savings of more than 26 million kilowatt hours per year (energy to serve approximately 3,600 homes)

Climate Change

- **Some Things PNM is Doing**
 - Inventory and reporting of Greenhouse Gases
 - Participation in national programs to fund carbon capture technology
 - Clean energy technologies and resources
 - Alternative fuel fleet vehicles
 - Founding leader in the USCAP

www.us-cap.org





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Advanced Coal Generation and Carbon Capture & Sequestration

Advanced Coal Technology

General Definition:

- **Increased/high efficiency**
- **Reduced amounts of all emissions and pollutants**
- **Technology neutral**



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Questions

How does NM's Advanced Energy Tax Credit apply to coal generation?

- **Initiate construction by 12/31/15**
- **Emissions limits – lesser of BACT or:**
 - SO₂ = 0.035 lb/mmBtu
 - NO_x = 0.025 lb/mmBtu
 - PM = 0.01 lb/mmBtu
 - Hg = 90% reduction
- **CCS to 1,100 lbs/MWh by later of 1/1/17 or 18 months after commercial operation**
- **Unit less than 700 MW net**
- **Tax credit of 6% up to \$60 million over up to 5 years**

To what extent does regulation of GHG emissions factor into PNM's development process?

- **NMPRC requires modeling of CO2 costs of \$8, \$20 and \$40 in all resource planning efforts**
- **Uncertainty associated with GHG rules, including CCS, makes planning efforts more challenging**
- **Currently evaluating a suite of generation technologies and options**



How close is NM to implementing carbon constraints?

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To what extent is PNM involved in CCS?

- **Active member of the Southwest Regional Partnership for Carbon Sequestration**
- **Active member in New Mexico Energy, Minerals and Natural Resources Department Oil Conservation Division Climate Change Working Group**
- **Leading efforts to obtain federal support for large-scale CCS demonstration projects through USCAP, EPRI, EEI, etc.**
- **Investigating/evaluating CCS technologies**

What are the most significant boundaries to deployment of CCS?

In no particular order:

- **Lack of Federal/National GHG rules**
- **Lack of Federal/National CCS rules, including**
 - Permitting
 - Eminent domain (pore space, pipelines)
 - Long-term liability
 - MMV
 - Right of entry for testing and MMV
- **Lack of proven and cost-effective carbon capture technologies – and large scale demonstration**

What are the most promising technologies for coal-fired power plants?

Existing Plants:

- **PC: chilled ammonia, advanced amines**
- **IGCC: Selexol, Rectisol, advanced amines**
- **All: efficiency improvements**

New Plants:

- **PC: SCPC/USCPC, chilled ammonia, advanced amines, oxyfuel combustion**
- **IGCC: Selexol, Rectisol, advanced amines**

What governmental policies would help accelerate development and deployment of ACTs?

- **Reasonable Federal/National GHG and CCS rules**
- **RD&D**
 - Significant, timely and sustained funding
 - Range of technologies (technology neutral - don't predetermine winners and losers)
 - Drive to commercialization

What governmental policies would help accelerate development and deployment of ACTs? (cont'd)

➤ **Incentives**

- Financial (tax credits, accelerated depreciation, grants, loan guarantees, etc. – possibly increased support for early adopters?)
- Streamlined permitting and longer duration permits for all components (plant, CCS, pipeline, etc.)
- Regulatory certainty
 - Rate recovery during construction
 - Recovery if project doesn't work as planned or is cancelled for valid reason
- Modify NSR rules to allow for efficiency improvements

What governmental policies would help accelerate development and deployment of ACTs? (cont'd)

➤ **Risk Management**

- Technology risk (results in huge mark-ups)
- Rate risk
- Shareholder risk
- CCS liability

➤ **Education**

- Policymakers/lawmakers
- Public



What is the current thought on the viability of new IGCC plants, potential roadblocks and areas of opportunity?

IGCC is good, but not only ACT available

➤ **Technology challenges**

- Costs, demonstration of various technologies on a variety of fuels (i.e. western fuels at high elevations), large scale and sustained funding, etc.

➤ **Regulatory hurdles**

- Federal/National GHG and CCS rules, regulatory certainty

➤ **Public perception**

- Clean coal, GHG, CCS, etc. are tough issues to understand

Other questions?

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