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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

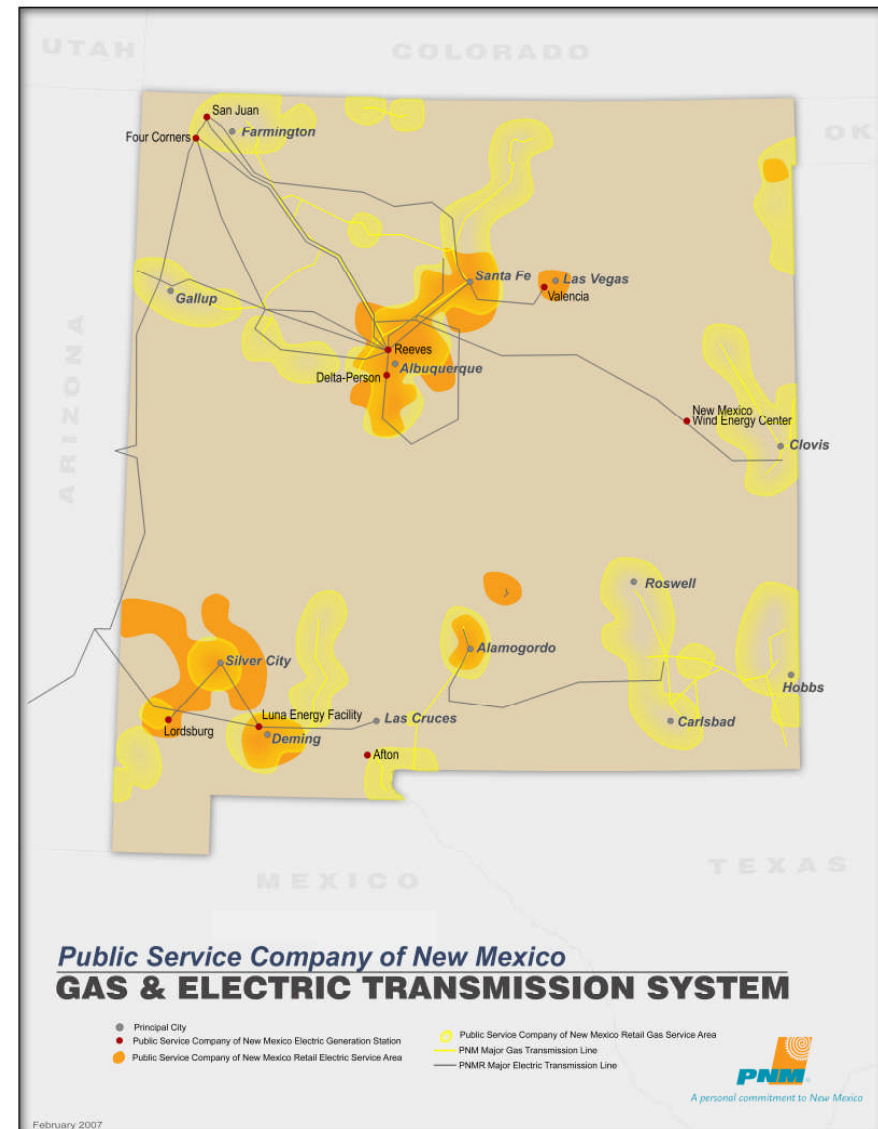


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# Background on PNM

# 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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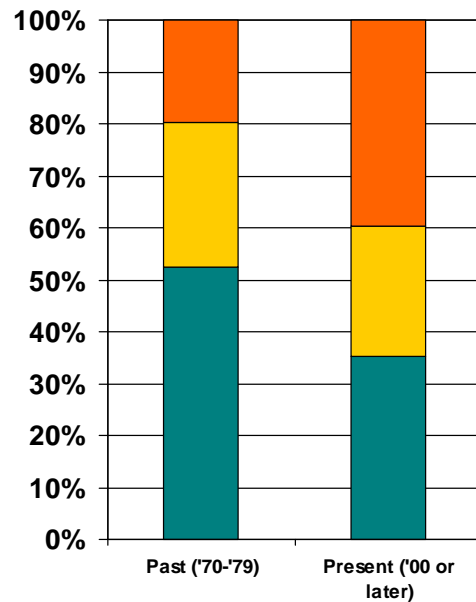
# Challenges Facing PNM

# Increased Customer Demand

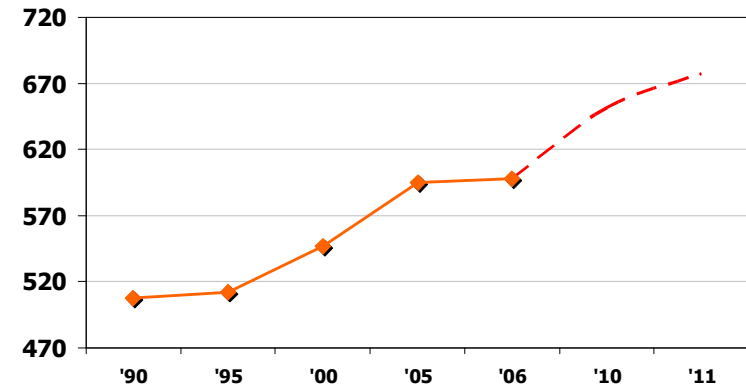
- **Present State of the Electric Utility Industry**
  - Americans use 21% more electricity than they did in 1978
  - Electricity consumption is expected to increase by at least 40% by 2030
  - Industry will spend approximately \$412 billion to meet increased demand
    - Building cycle for new generation,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

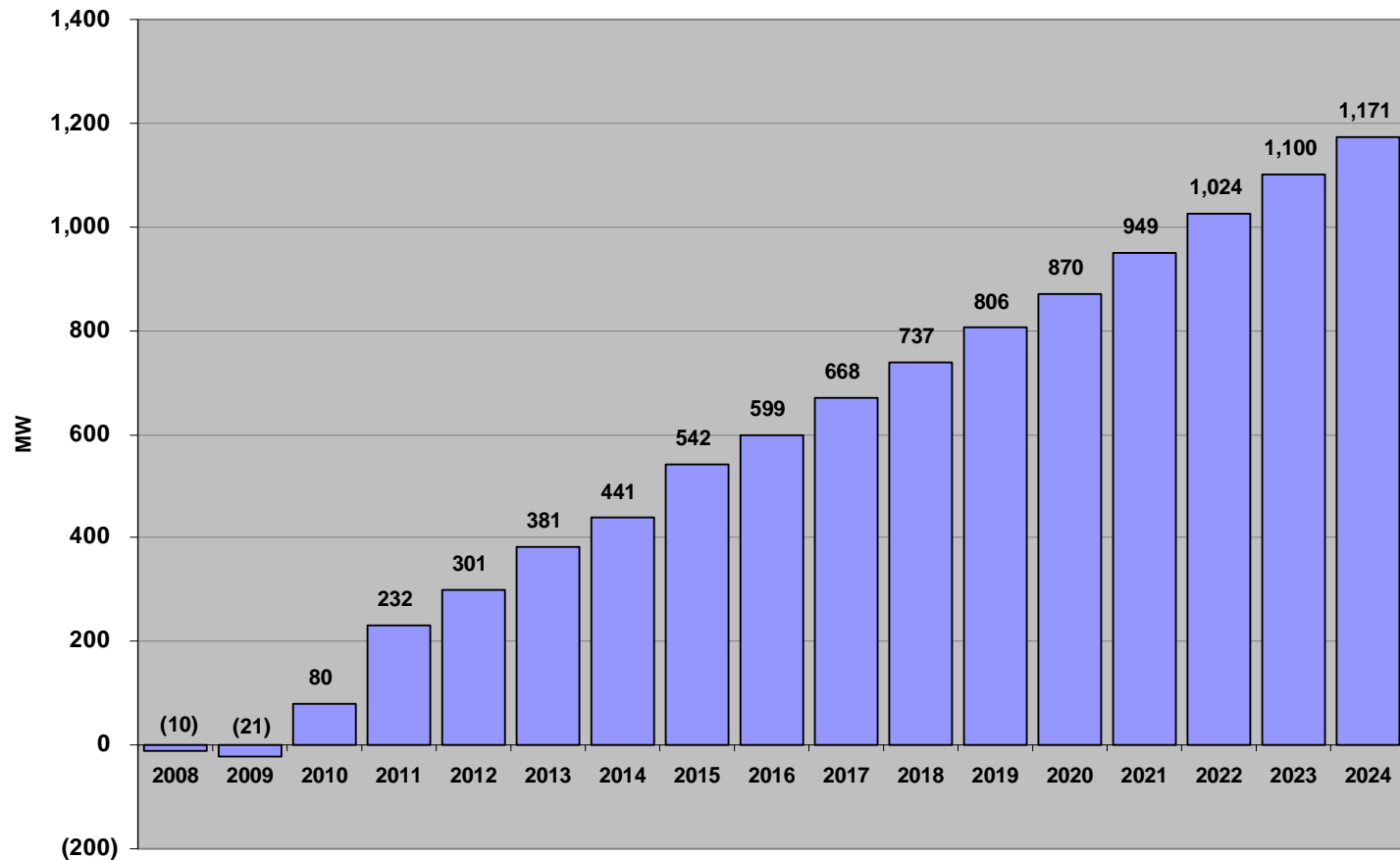






# Meeting Increased Customer Demand

## PNM's Future Resource Needs

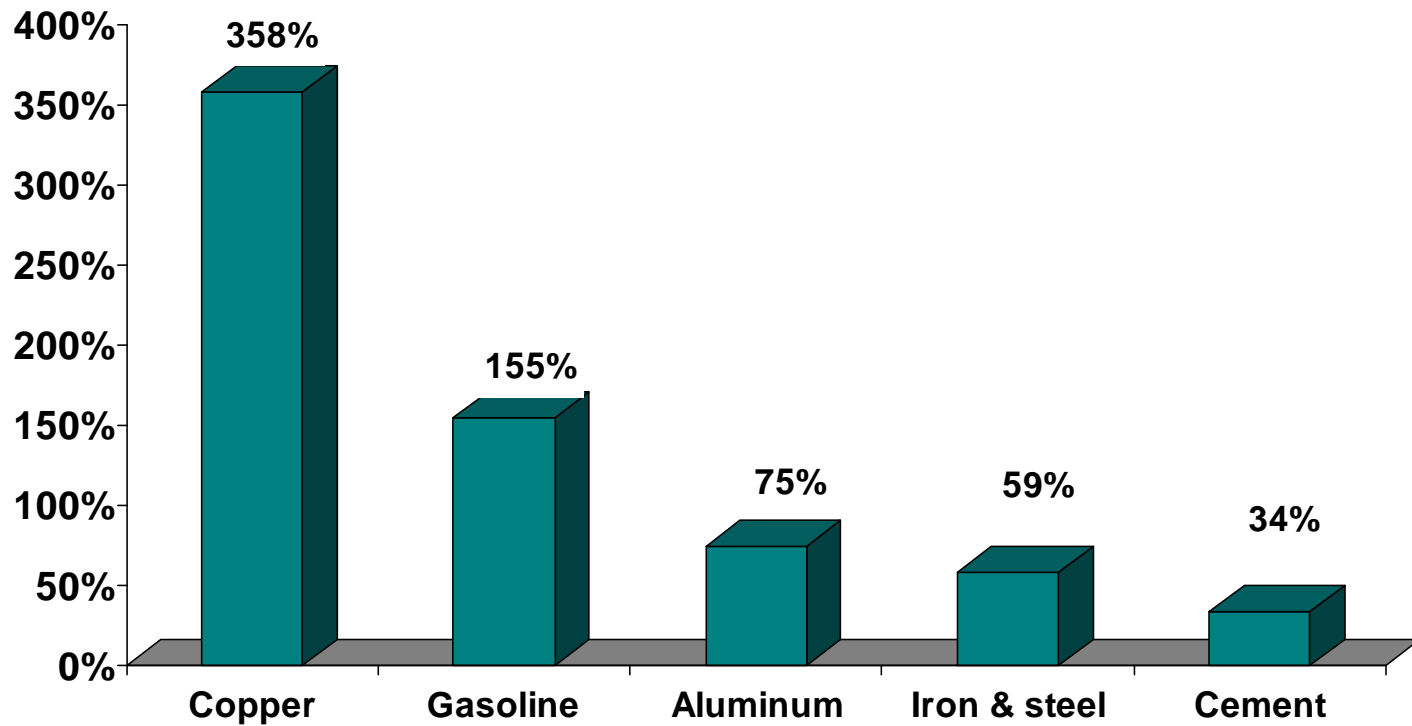


Average system growth of 3 to 4 percent a year



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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

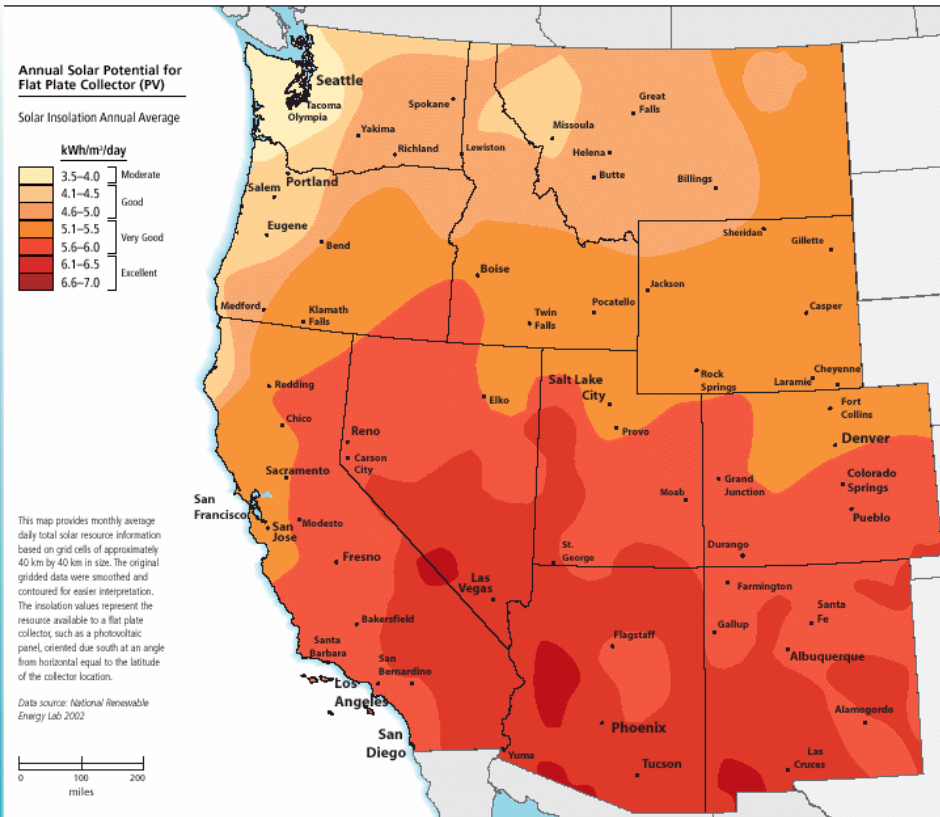
# Clean Energy Resources

## ➤ 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](http://www.us-cap.org)







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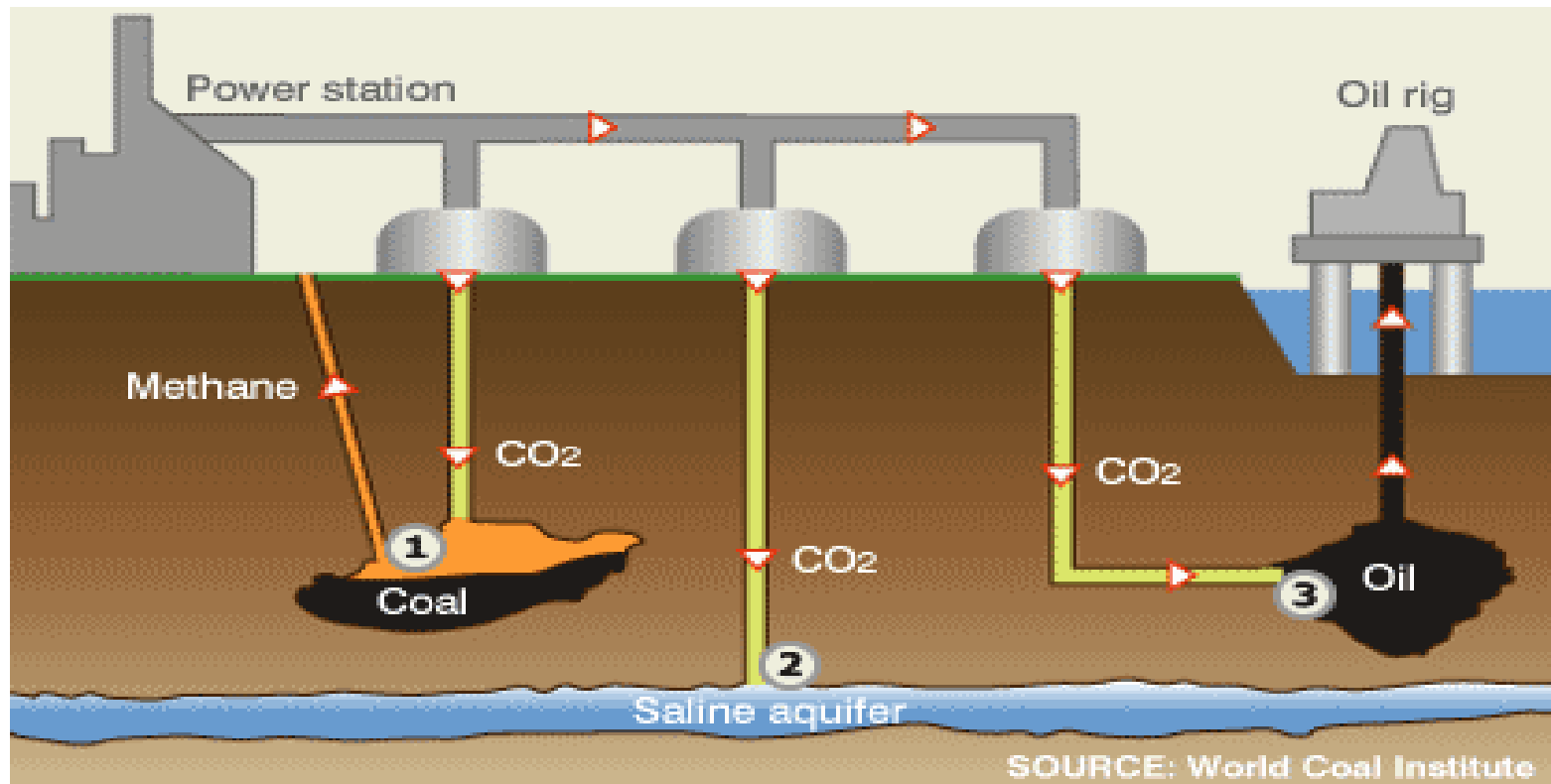
# Advanced Coal Generation and Carbon Capture & Sequestration

# Advanced Coal Technology

## General Definition:

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

# Carbon Capture & Sequestration



1. Methane production from unmineable coal seams
2. Injection into deep saline formations
3. Enhanced Oil Recovery (EOR)



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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:**
  - SO<sub>2</sub> = 0.035 lb/mmBtu
  - NO<sub>x</sub> = 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?

?



## 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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