Section D:

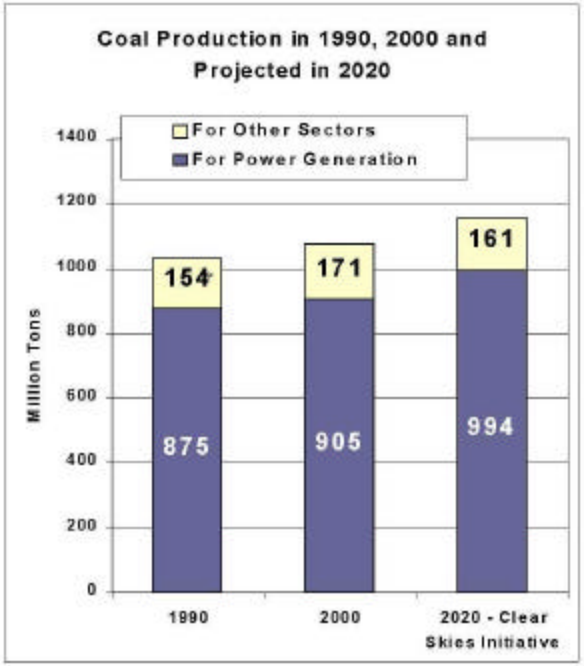
Projected Impacts on Generation and Fuel Use

National Coal Production in 1990 and 2000, and Projected Production under Clear Skies in 2020

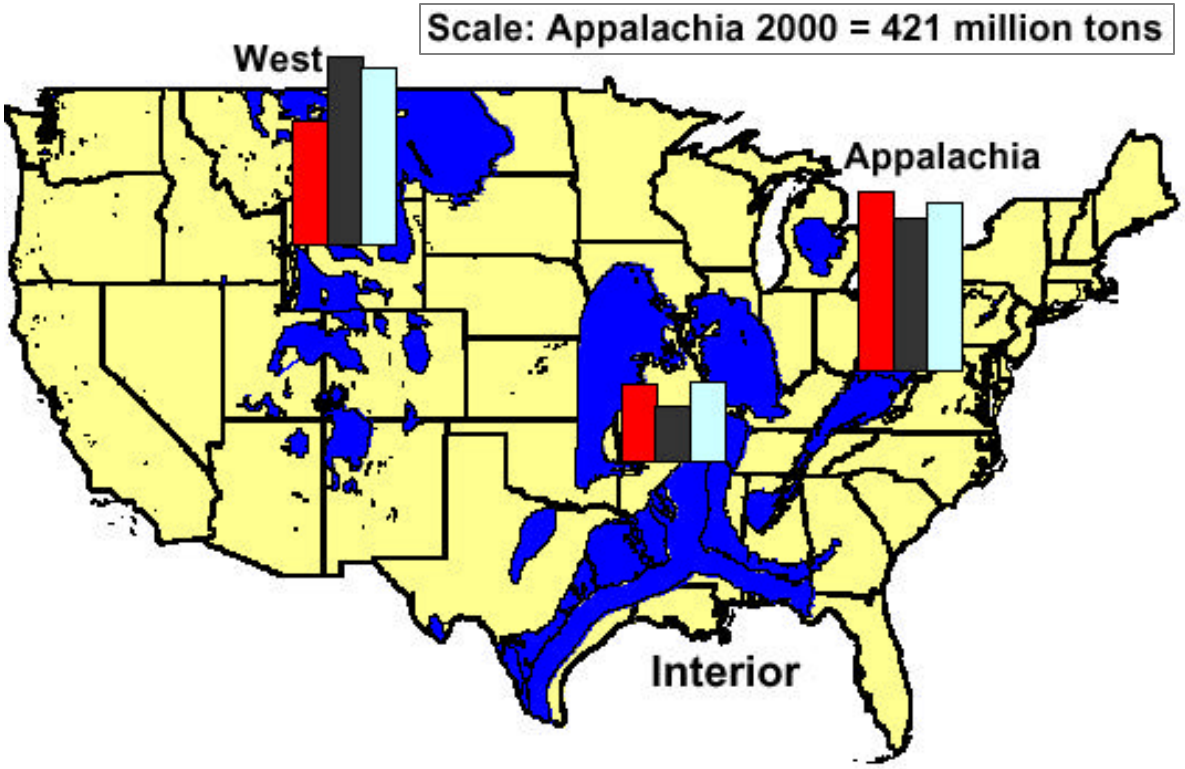
1990 National Coal Production

2000 National Coal Production

2020 National Coal Production under CSA



Note: In 1990, EIA did not report the coal produced for power generators. From 1998-2000, 85% of coal produced was for the power generation sector. For an estimate of coal produced for the power generation sector in 1990, EPA assumed the same percentage (85%).



Note: 2020 national coal production projections are EPA estimates from IPM.

1990 data: Coal Industry Annual 1994, Table 4 (DOE/EIA-0584 (2000)).

2000 data: Coal Industry Annual 2000, Table 4 and Table 63 (DOE/EIA-0584 (2000)), January, 2002.

2020 production for the power generation sector: Derived from the Integrated Planning Model.

2020 production for other sectors: Derived from the National Energy Modeling System.

Coal Production and Employment Impacts

Coal Production in 1990 and 2000, and Projected in 2020 under Clear Skies (million tons)			
Region	**1990**	**2000**	**2020 under Clear Skies**
Appalachia	489	421	461
Interior	206	145	214
West	334	510	481
Total	**1,029**	**1,076**	**1,155**

Note: 2020 national coal production projections are EPA estimates from IPM. Totals may not sum due to rounding. Regions are based on DOE regional definitions. Appalachia includes Northern, Central and Southern Appalachia. Interior includes Midwest, Central West and Gulf. West includes far West.

1990 and 2000 data: Coal Industry Annual 1994, Table 4 (DOE/EIA-0584 (1994)), and Coal Industry Annual 2000, Table 4 (DOE/EIA-0584 (2000)).

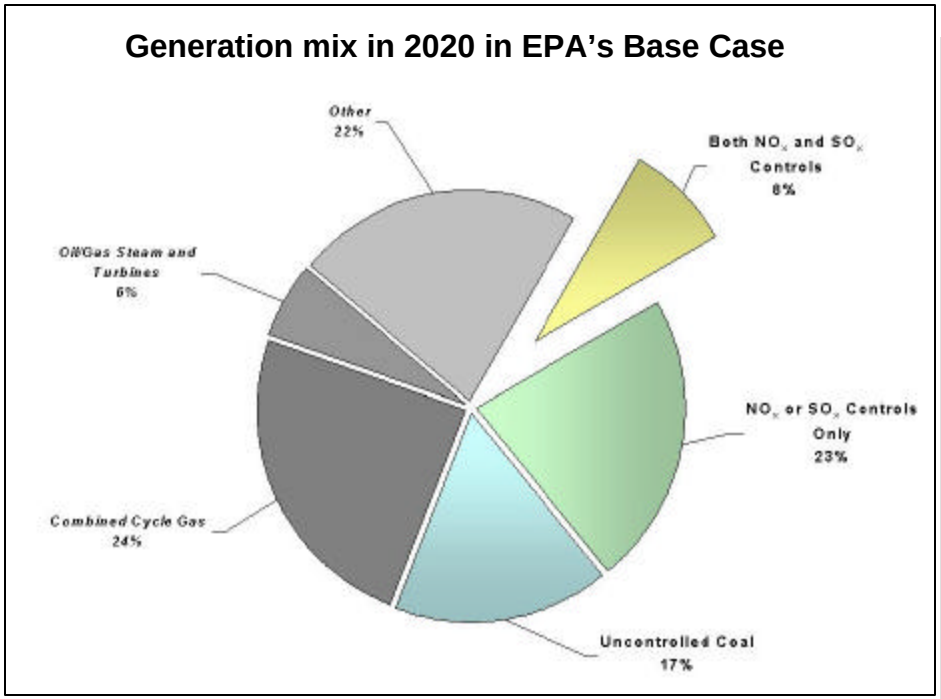
2000 data: 2020 production under Clear Skies: Derived from the Integrated Planning Model and the National Energy Modeling System.

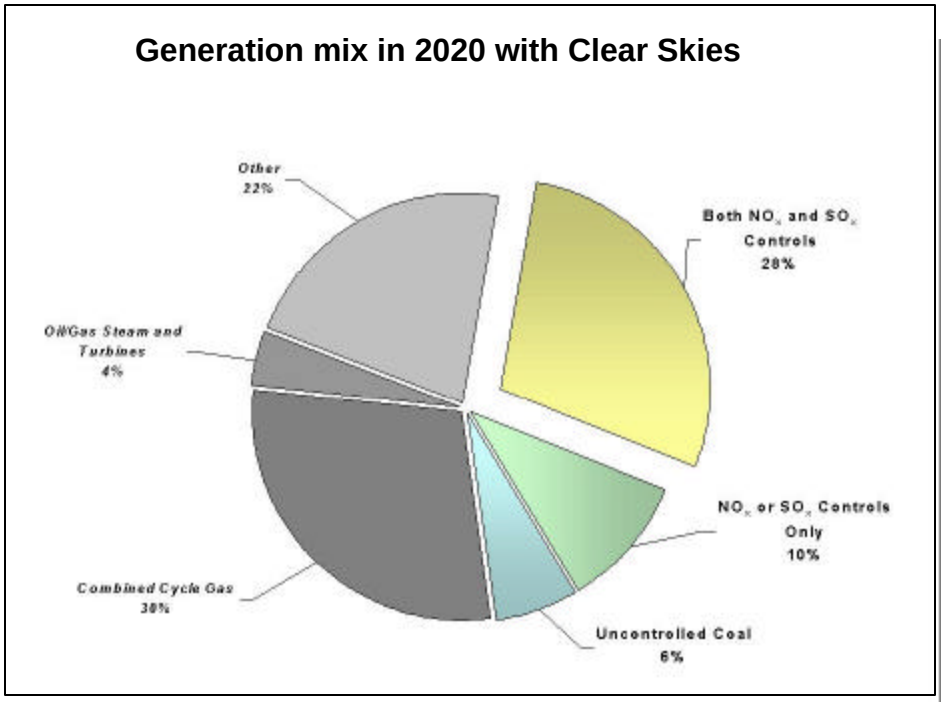
Changes in Coal Mining Jobs under Clear Skies, relative to the Base Case		
Coal Producing Region	**2005**	**2020**
Appalachia	-460	491
Interior	2,000	2,519
West	-588	-1,611
National Total	**952**	**1,399**

Source: ICF Analysis, September 2002.

Notes: Regions are based on DOE regional definitions. Appalachia includes Northern, Central and Southern Appalachia. Interior includes Midwest, Central West and Gulf. West includes far West.

Projected Generation Mix in 2020

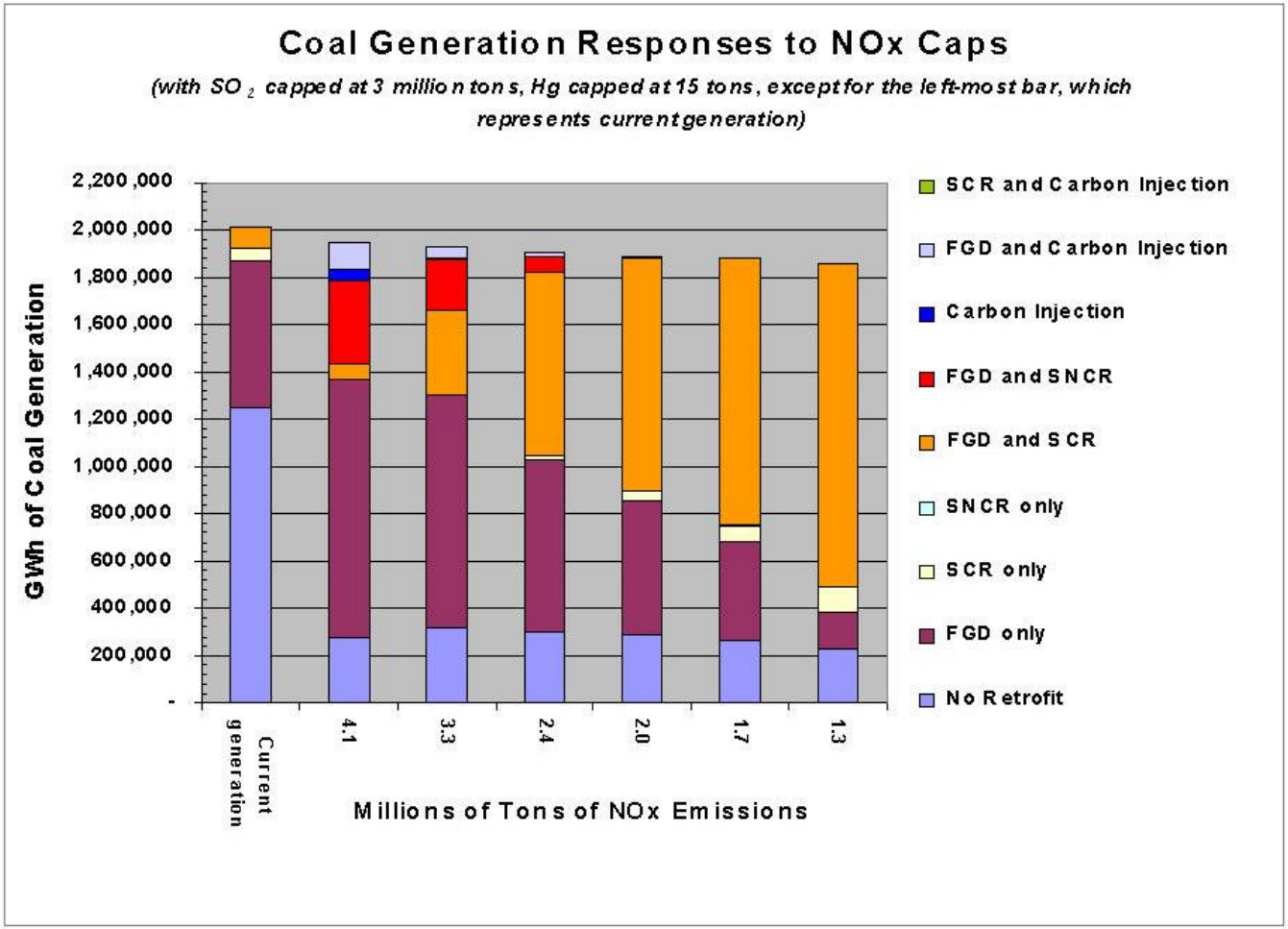




Note: Controlled Coal includes units with post-combustion SO_2 and/or NOx controls. "Uncontrolled Coal" could include PM and/or NOx combustion controls. The EPA 2000 Base Case in IPM includes Title IV, the NOx SIP Call, and state-specific caps in CT, MO and TX.

2020 generation mix: Projections are from EPA's modeling using IPM, The "Other" category includes generation from solar, wind, geothermal, biomass, landfill gas, and fuel cells. Control technology percentages are approximations. "Scrubbers and SCR" includes a very small amount of SNCR. "Scrubbers only" includes a very small amount of IGCC. "SCR only" includes a very small amount of SNCR. "SNCR only" includes a very small amount of gas reburn. "ACI" includes ACI retrofits on combinations of scrubbers and SCR.

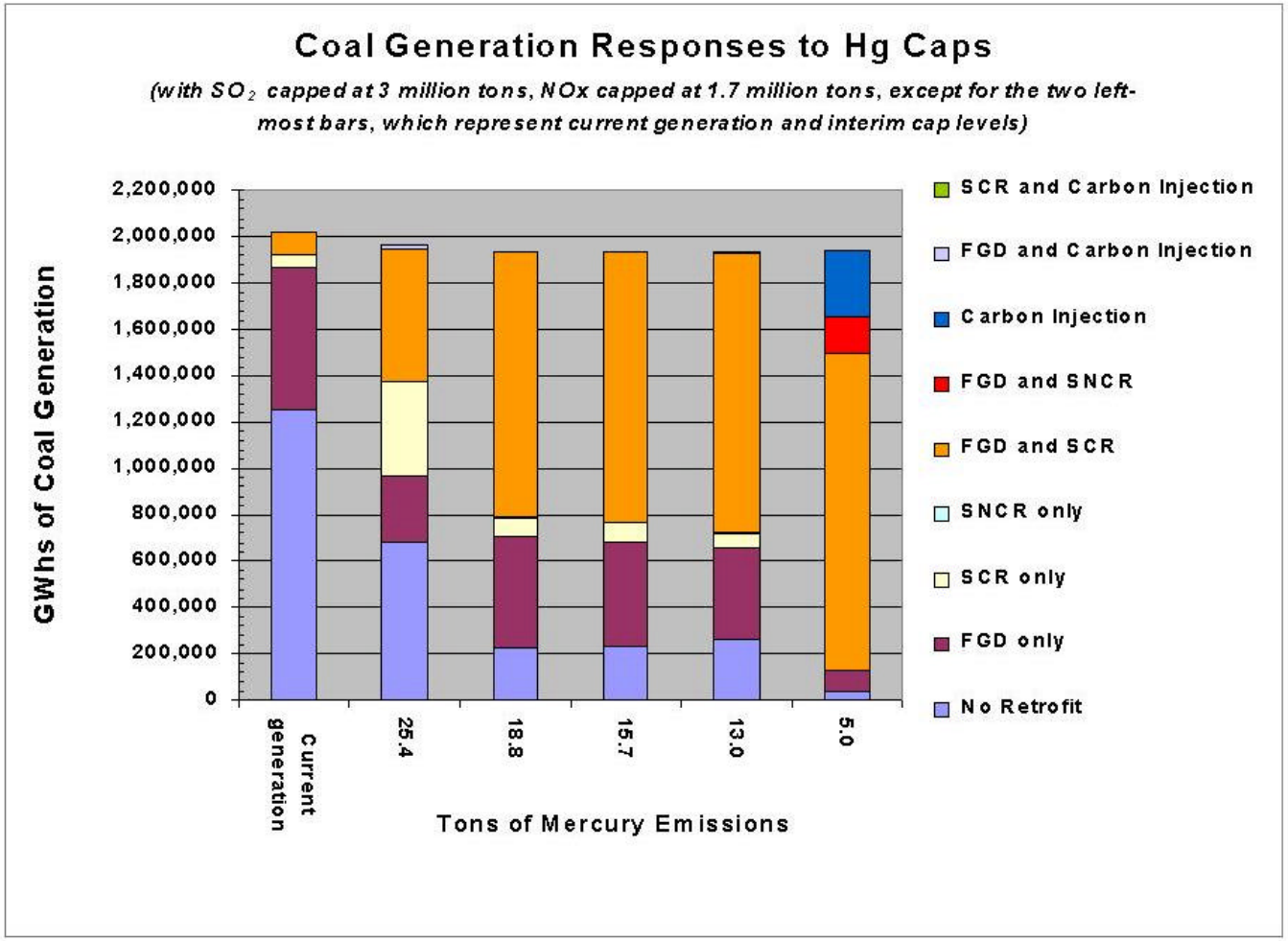
Technology Response to Varying Cap Levels



- At a 1.7 million ton NOx cap on electricity generators, only a small portion of the coal generation is projected to remain without controls. This uncontrolled portion is comprised primarily of smaller units. Most of the generation is projected to retrofit with FGD and/or SCR.

Note and Abbreviations: This analysis used the Technology Retrofit and Updating Model. This analysis did *not* consider the feasibility of installing controls in the 2010 timeframe. SCR is selective catalytic NOx reduction, carbon injection is a mercury control technology, FGD is flue gas desulfurization (i.e., scrubbers), and SNCR is selective non-catalytic NOx reduction.

Technology Response to Varying Cap Levels



- At a 15 ton Hg cap on coal-fired electricity generators, only a small portion of the coal generation is projected to remain without controls. This uncontrolled portion is comprised primarily of smaller units. Most of the generation is projected to retrofit with scrubbers (FGD) and/or selective catalytic reductions (SCR).

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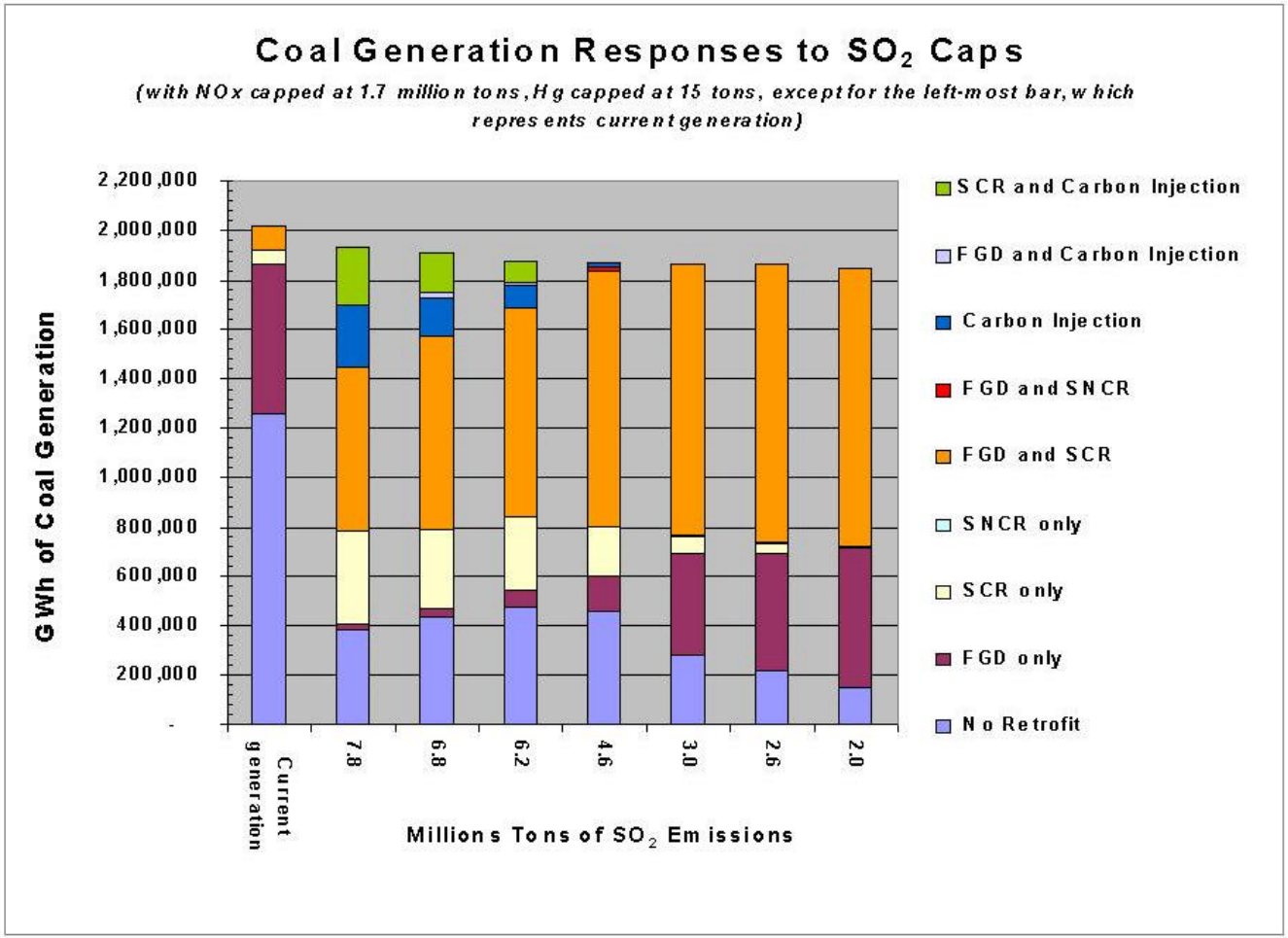
Technology Response to Varying Cap Levels

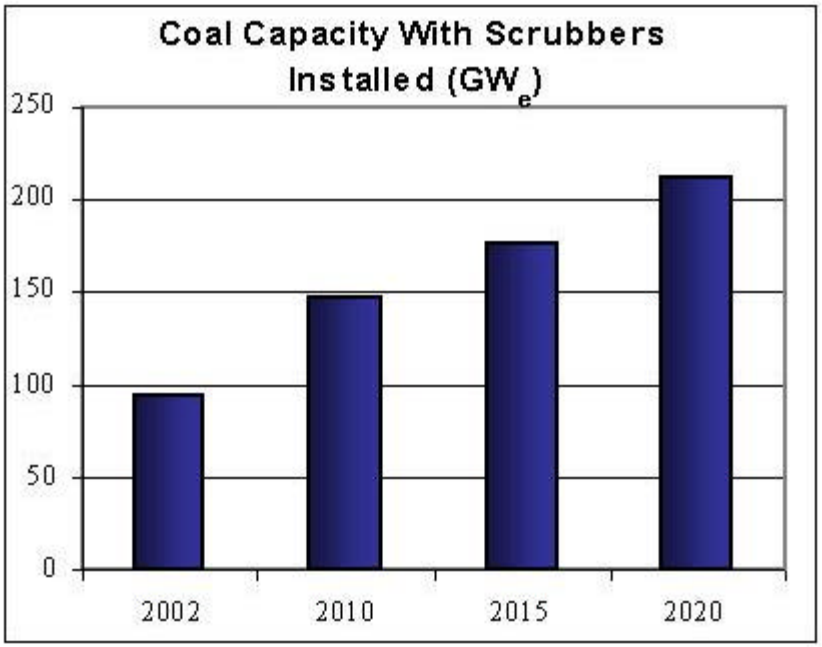


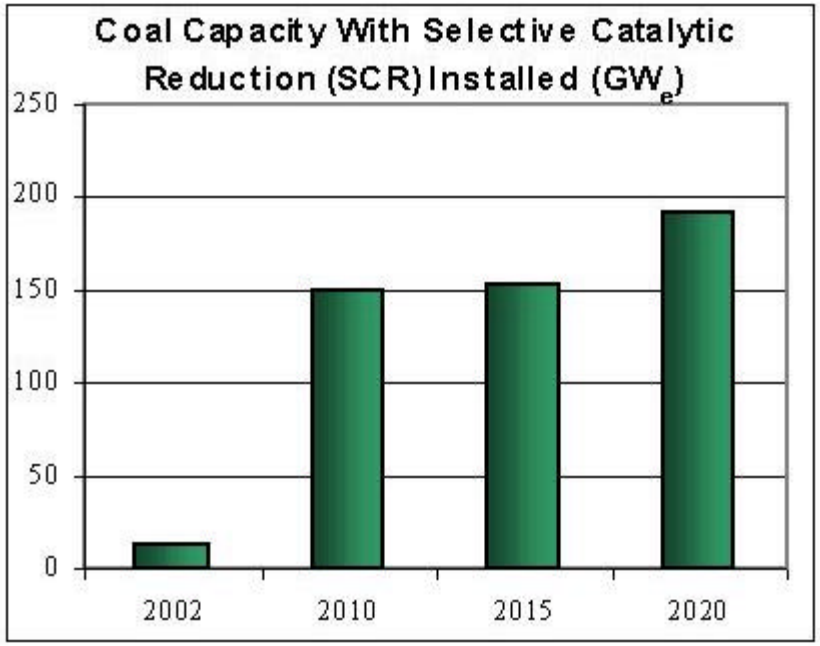
- At a 3 million ton SO_2 cap, a portion of the coal generation is projected to remain without controls. This uncontrolled portion is comprised primarily of smaller units. Most of the generation is projected to retrofit with FGD and/or SCR.

Note and Abbreviations: This analysis used the Technology Retrofit and Updating Model. This analysis did *not* consider the feasibility of installing controls in the 2010 timeframe. SCR is selective catalytic NOx reduction, carbon injection is a mercury control technology, FGD is flue gas desulfurization (i.e., scrubbers), and SNCR is selective non-catalytic NOx reduction.

Projected Coal Capacity with Emissions Controls

- In 2020 under Clear Skies, 85% of all coal-fired generation comes from controlled coal.*
- Graphics show cumulative capacity with existing controls, controls projected to be retrofitted under the NOx SIP call and Title IV, and controls projected to be retrofitted under Clear Skies.





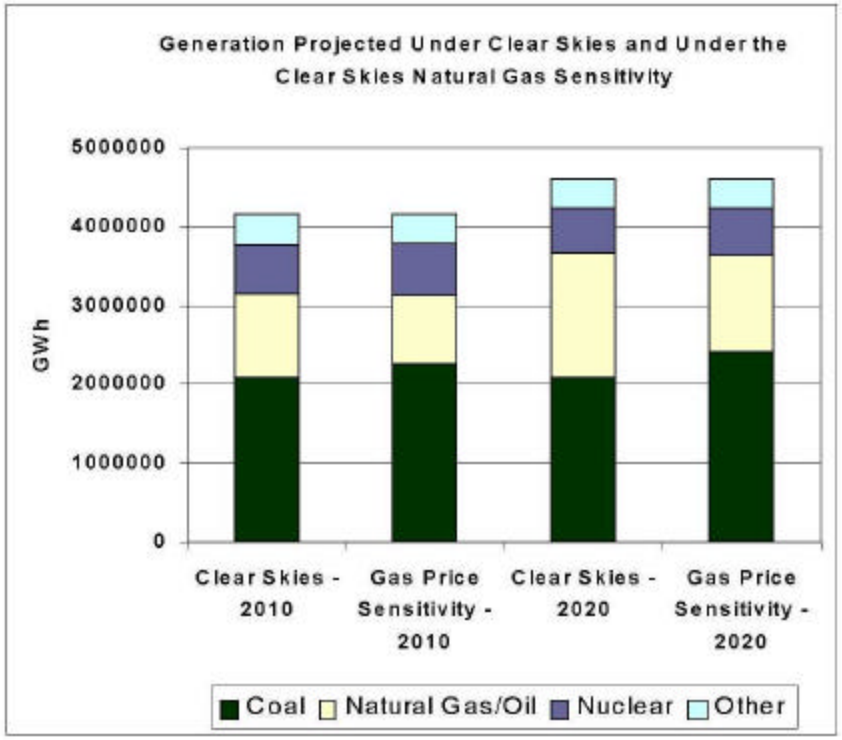
Note: Retrofit projections are EPA's analysis using IPM. "Controlled coal" includes one or more of the following: SCR, scrubbers, ACI, gas re-burn and SNCR.

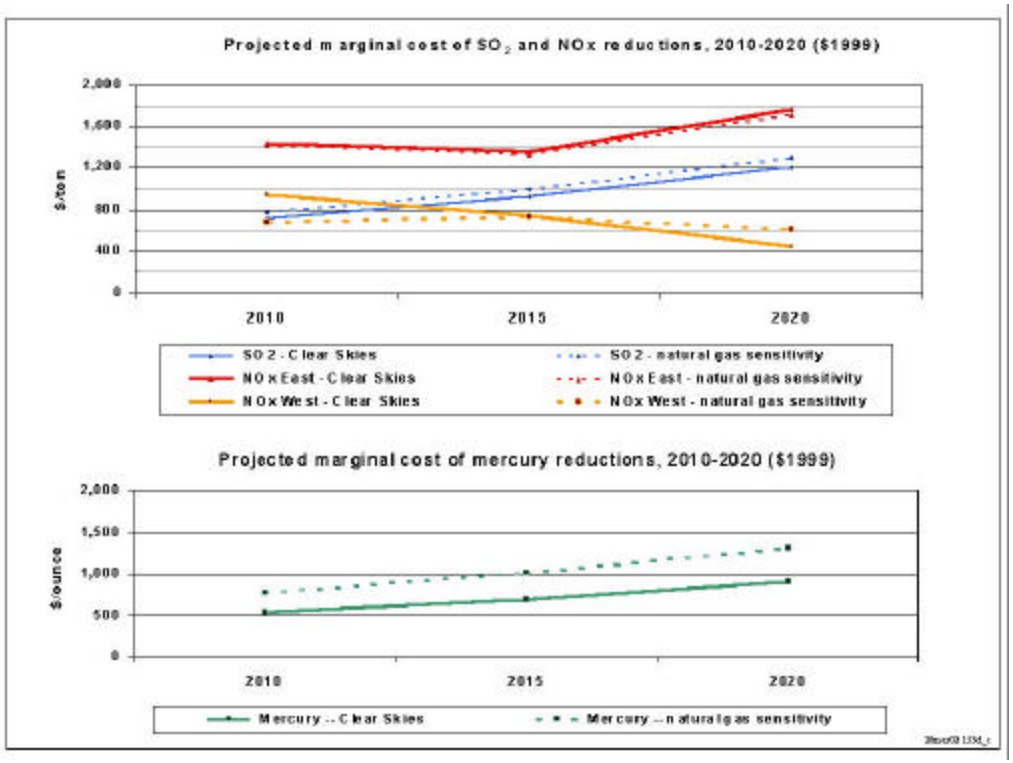
Impact of Changes in Natural Gas Prices and Mercury Control Efficiency

- **Several key modeling assumptions in IPM that underlie the analysis of Clear Skies have been challenged by stakeholders. These include:**
  - The natural gas prices in the model.
  - The mercury removal efficiency of a combination of scrubbers and SCR.
- **EPA has run a number of sensitivities that explore the impact of changes in these modeling assumptions. Specifically:**
  - EPA shifted the natural gas supply curve in IPM up $0.80/MMBtu, or approximately 30%, to analyze concerns about low natural gas prices in the model.
  - EPA reduced the mercury removal efficiency of the combination of scrubbers and SCR from 95% to 80.

Impact of Changes in Natural Gas Prices

- Shifting the natural gas supply curve in IPM up $0.80/MMBtu, or approximately 30%, results in the following impacts on generation and marginal costs.

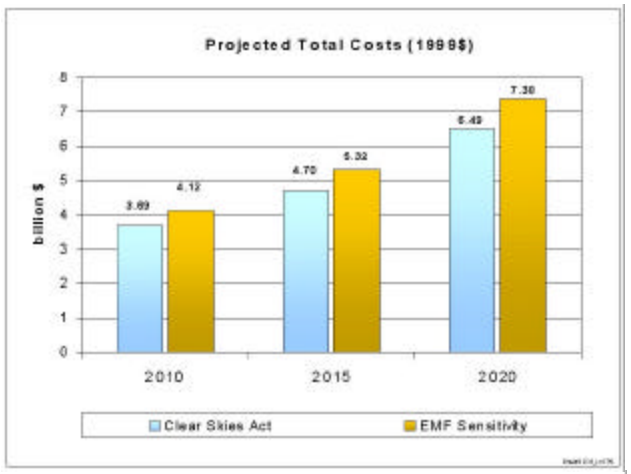


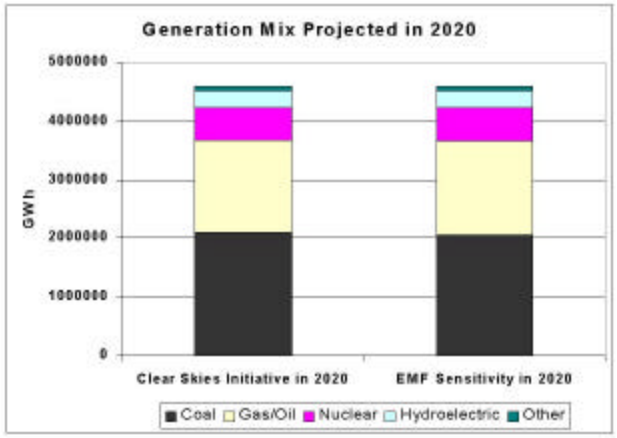


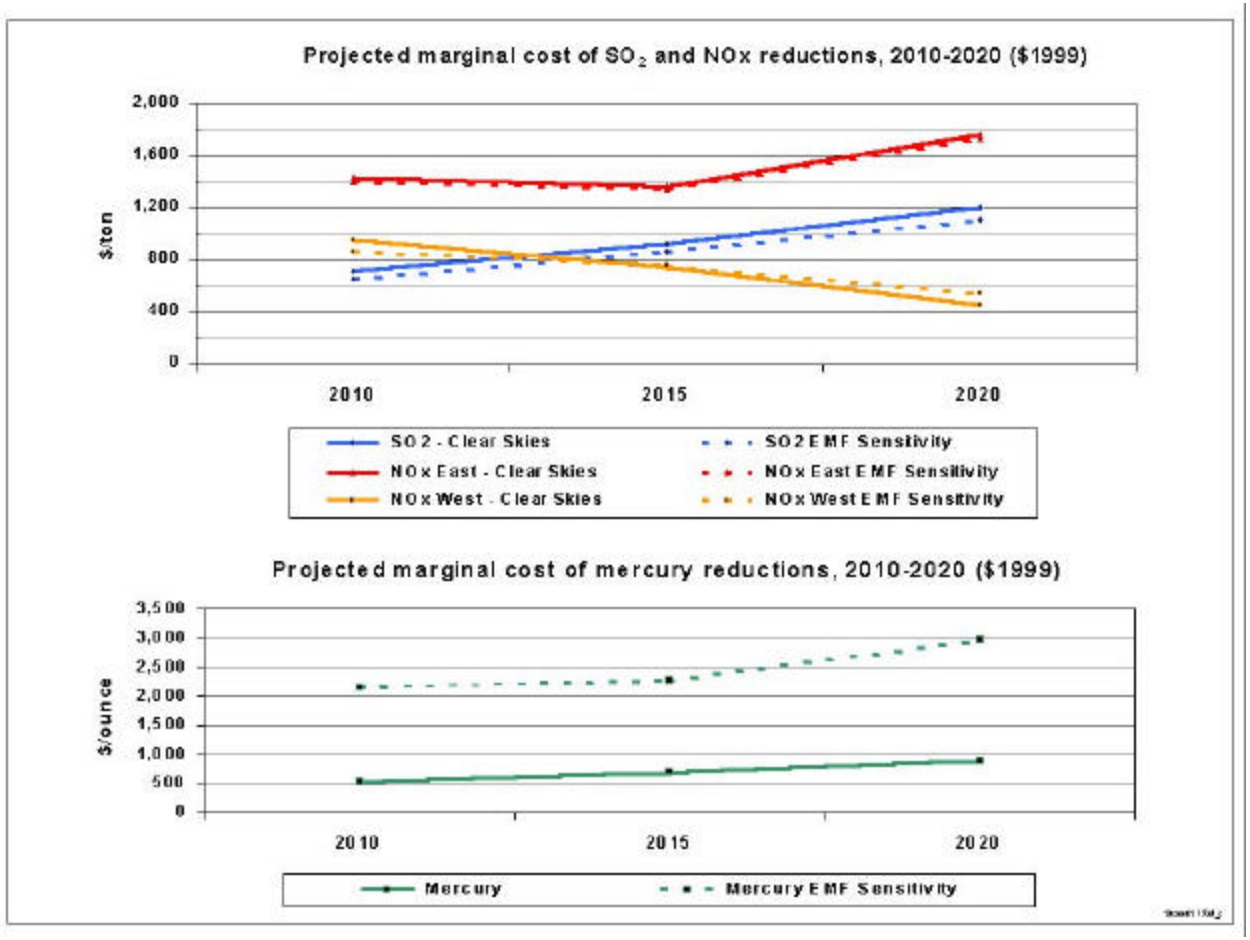
Note: For more information on the gas supply curves used in IPM see Chapter 8 and the Appendix to chapter 8 at http://www.epa.gov/airmarkets/epa-ipm/index.html#documentation,

Varying Effectiveness of Mercury Control Technologies

- Impacts of varying the assumptions regarding the mercury removal efficiency of a combination of SCR and FGD were examined using IPM; the results are compared to the Clear Skies policy with standard assumptions.







Note: See the IPM documentation, chapter 5, table 5.7a (http://www.epa.gov/airmarkets/epa-ipm/index.html#documentation) for more information and 5.3.2 for a definition of "Alternative Emission Modification Factors (EMFs)". An EMF is the ratio of outlet mercury concentration to inlet mercury concentration; EMF's capture the mercury reductions attributable to different unit configurations and different configurations of SO_2, NOx, and particulate controls.

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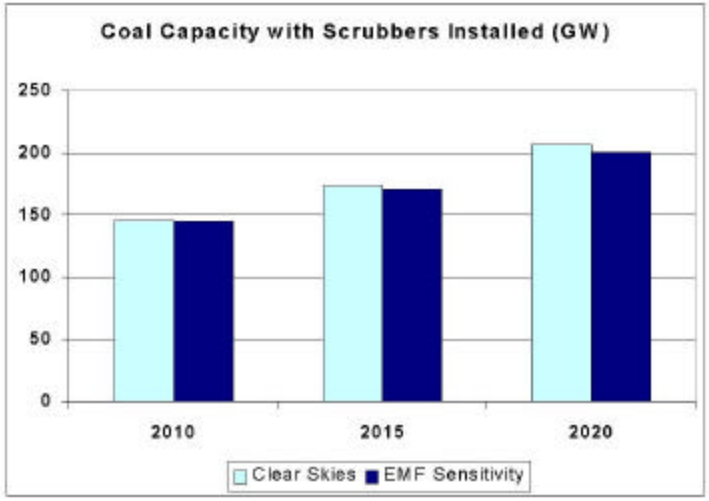

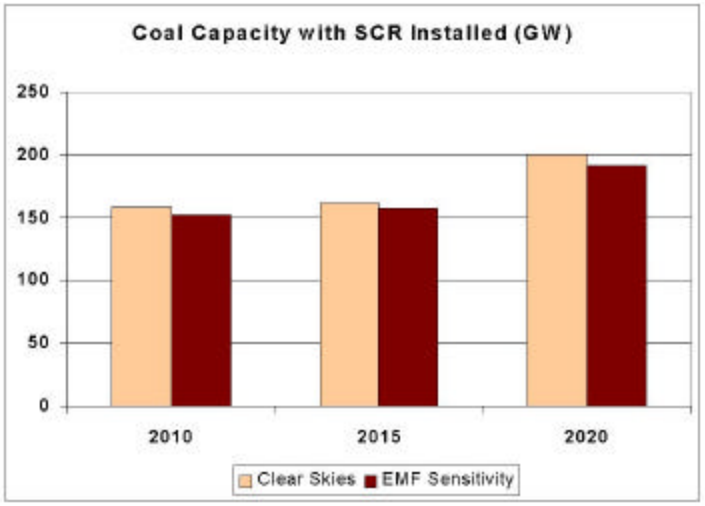

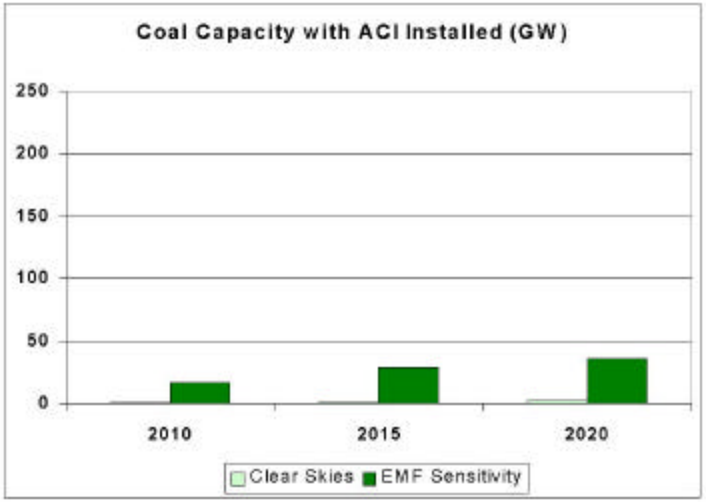

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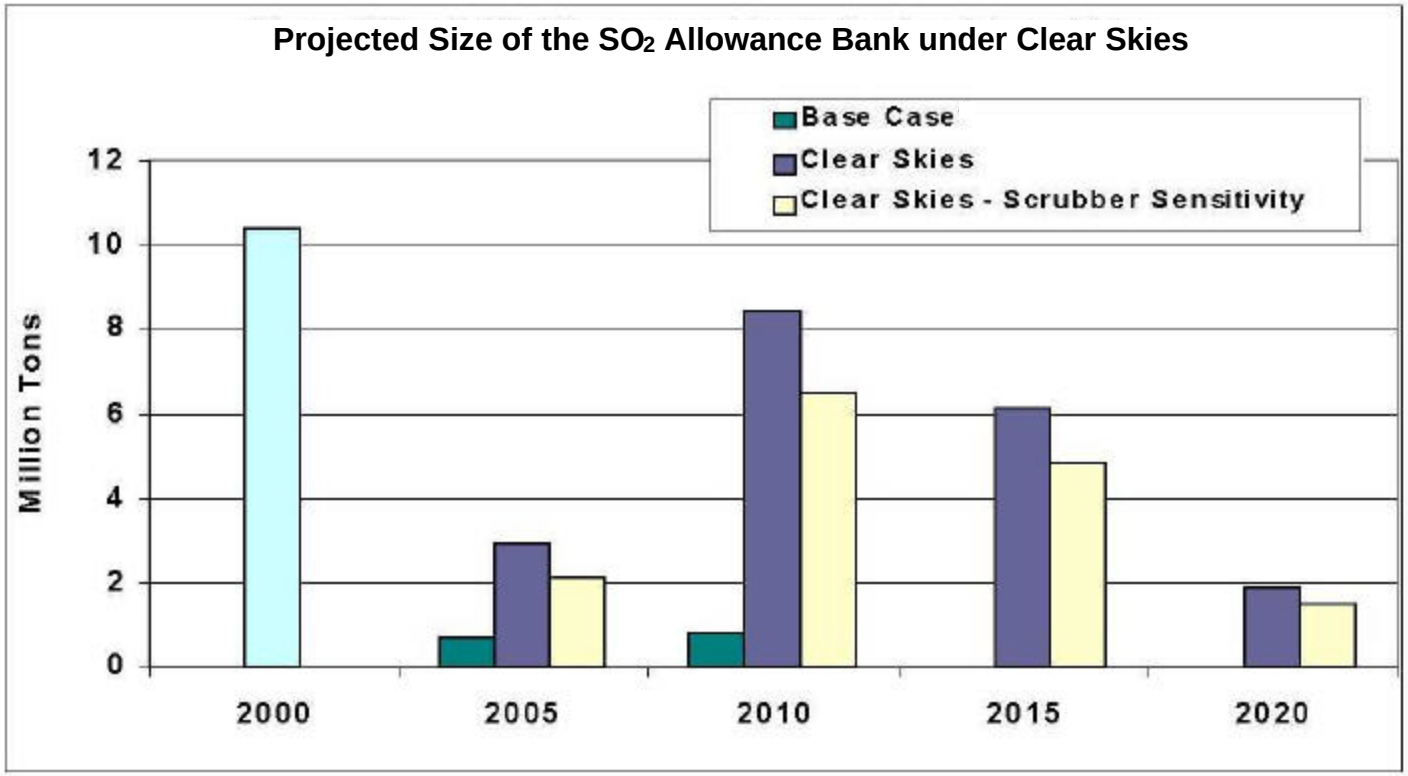
Impact of Alternative Scrubber Projections on the Size of the SO_2 Allowance Bank

- IPM modeling for Clear Skies has projected that approximately 32 GW would be economical to install by 2005; many industry groups stated that it would not be able to retrofit this much capacity in such a short period, particularly since many units will already be installing controls to comply with the reduction requirements in the NOx SIP Call.
- EPA conducted a sensitivity analysis in which the scrubber installations were limited to only 10 GW in 2005, approximately 70% less than the model projects would occur. Even with fewer scrubbers installed by 2005, sources are projected to continue banking a significant number of SO_2 allowances.



Note: Projected allowance banking data is from IPM.