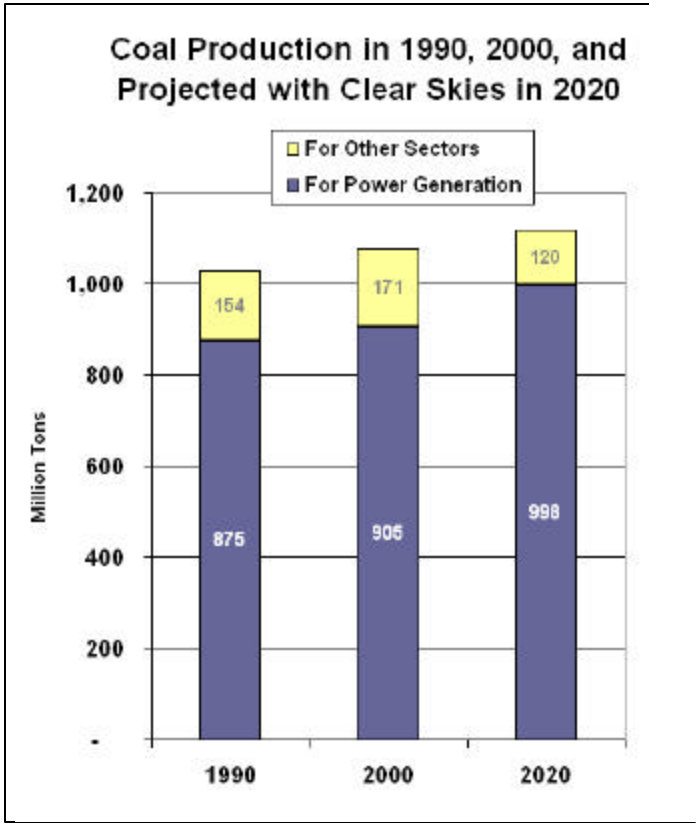
Section D:

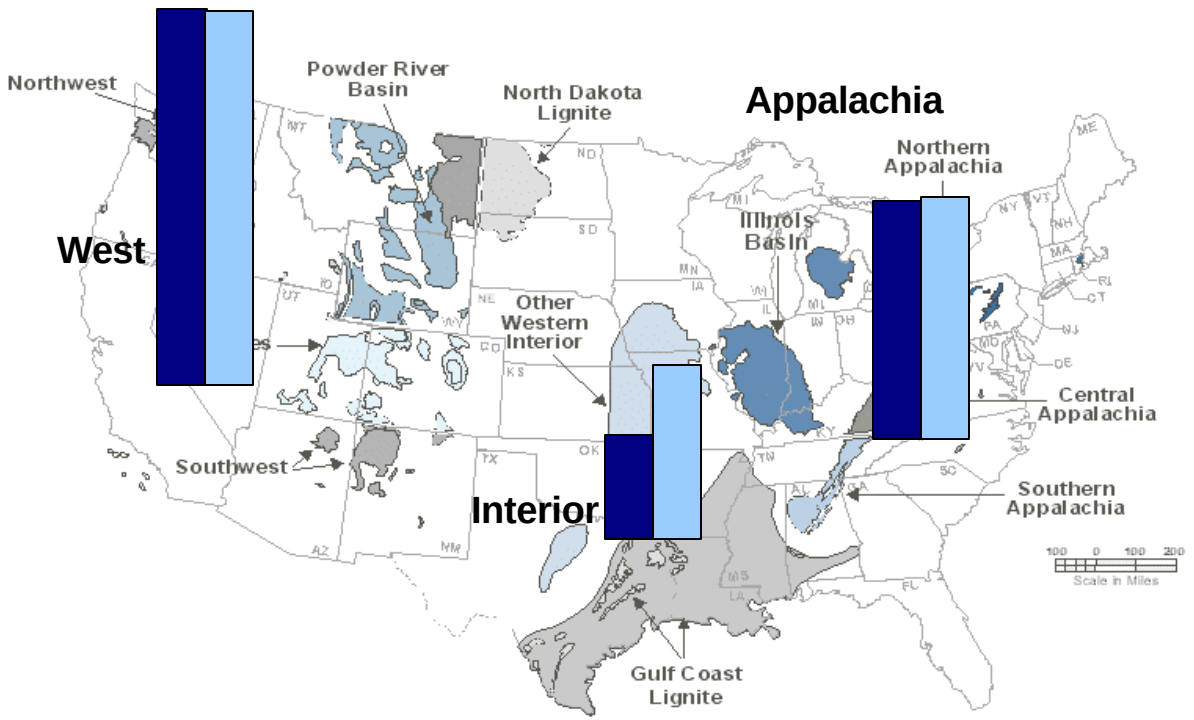
Projected Impacts on Generation and Fuel Use

Coal Production for Electricity Generation in 1990 and 2000 and Projected Production with Clear Skies in 2020

Coal Production for the Power Sector

- 2000 Actual
- 2020, Clear Skies





Scale: Appalachia 2000 = 299 million tons

Notes: 2020 national coal production projections are EPA estimates from IPM. 1990 data is from the Coal Industry Annual 1994, Table 4 (DOE/EIA-0584 (2000)). 2000 data is from the Coal Industry Annual 2000, Table 4 and Table 63 (DOE/EIA-0584 (2000)), January, 2002. 2020 production for the power generation sector is derived from the Integrated Planning Model. 2020 production for other sectors is derived from the National Energy Modeling System.

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: The analysis presented represents EPA's estimates. EIA's modeling would likely show different impacts.

Coal Production and Coal Miner Employment

- **Under Clear Skies, coal production shifts to the Interior and Appalachian regions, which require considerably more labor for mining.**

Coal Production for the Power Sector
(million tons)

Region	2000	Clear Skies in 2020
Appalachia	299	305
Interior	131	220
West	475	473
Total	905	998

Data for 2000 is from EIA's Coal Industry Annual, Table 63

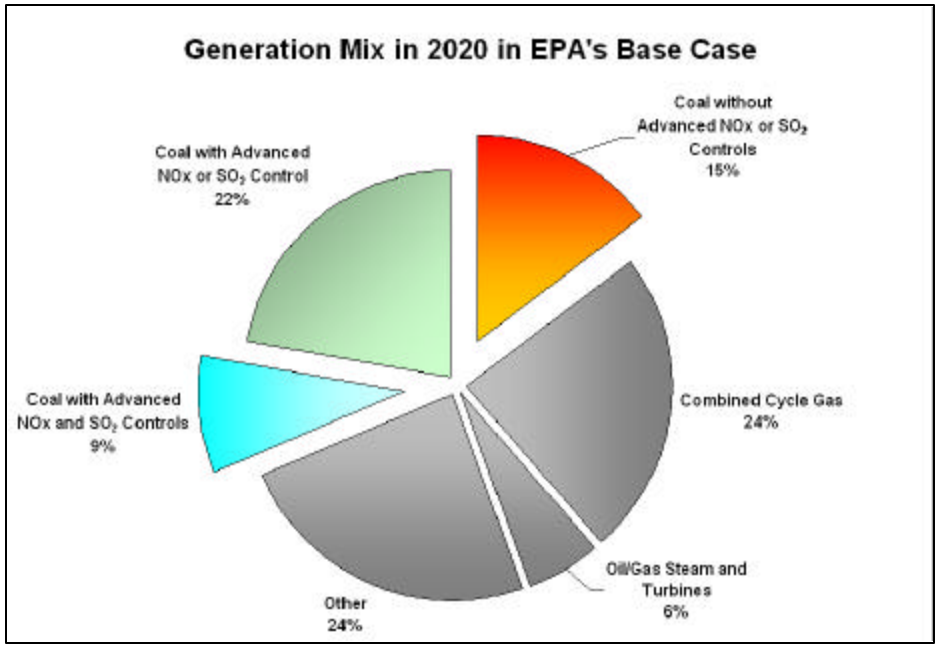
- **Coal miners, a group sensitive to possible changes in future fuel consumption, would see an increase in job opportunities.**

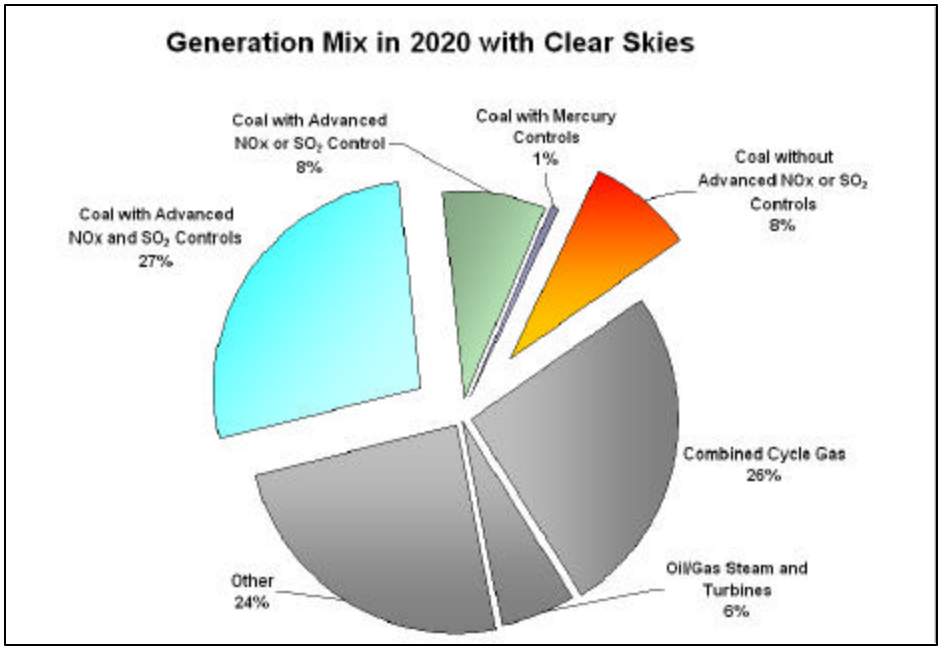
Change in Coal Mining Jobs, Relative to the Base Case

Coal Producing Region	2020
Appalachia	1,194
Interior	2,836
West	-1,033
Net Change	**2,997**

Notes:
1) Changes to coal miner jobs is the difference between coal miner employment in the policy case and the base case.
2) Coal miner productivity taken from EIA's Coal Industry Annual 2000. Coal miner productivity increases vary (2.1%-2.8%).
3) Data reflects employment and employment changes for EGU coal production only (roughly 85-90% of total coal production).
4) The base case in IPM includes Title IV, the NOx SIP Call, NSR settlements, and state-specific caps in CT, MA, MO, NC, NH, TX, and WI. It does not include mercury MACT in 2007 or any other potential future regulations to implement the current Clean Air Act.

Projected Generation Mix in 2020

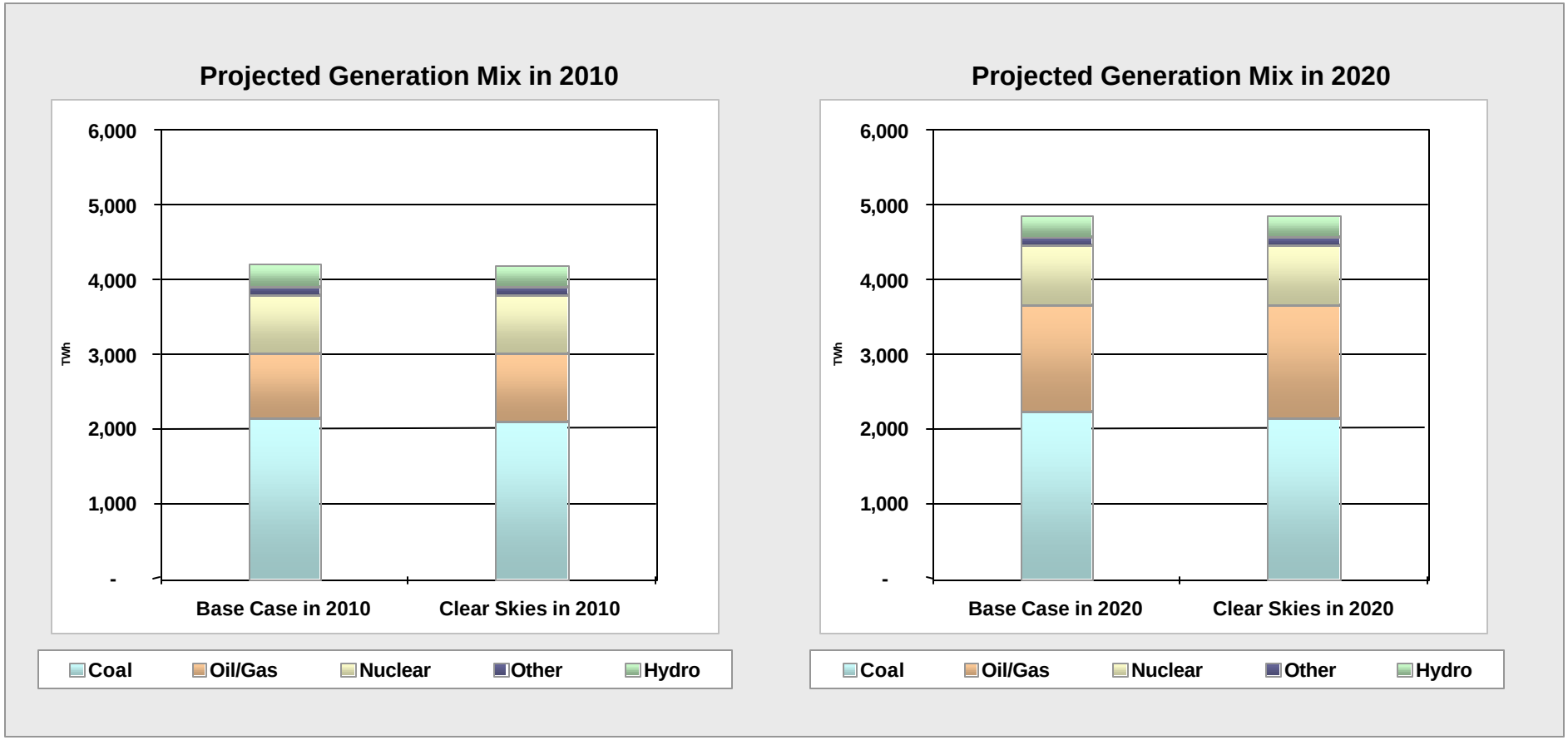




Note: Projections are from EPA's modeling using IPM. Coal units with SO_2 and/or NOx controls includes units with advanced post-combustion SO_2 and/or NOx controls (scrubbers for SO_2 removal and SCR or SNCR for NOx removal). Coal units without SO_2 and/or NOx controls could include PM and/or NOx combustion controls. The base case in IPM includes Title IV, the NOx SIP Call, NSR settlements, and state-specific caps in CT, MA, MO, NC, NH, TX, and WI. The "Other" category includes generation from nuclear, hydro, solar, wind, geothermal, biomass, landfill gas, and fuel cells. Control technology percentages are approximations. SO_2 controls include a very small amount of IGCC.

Note: The analysis presented represents EPA's estimates. EIA's modeling would likely show different impacts.

Projected Generation Mix in 2010 & 2020



Note: Projections are from EPA's modeling using IPM. The base case in IPM includes Title IV, the NOx SIP Call, NSR settlements, and state-specific caps in CT, MA, MO, NC, NH, TX, and WI. The "Other" category includes generation from solar, wind, geothermal, biomass, landfill gas, and fuel cells.

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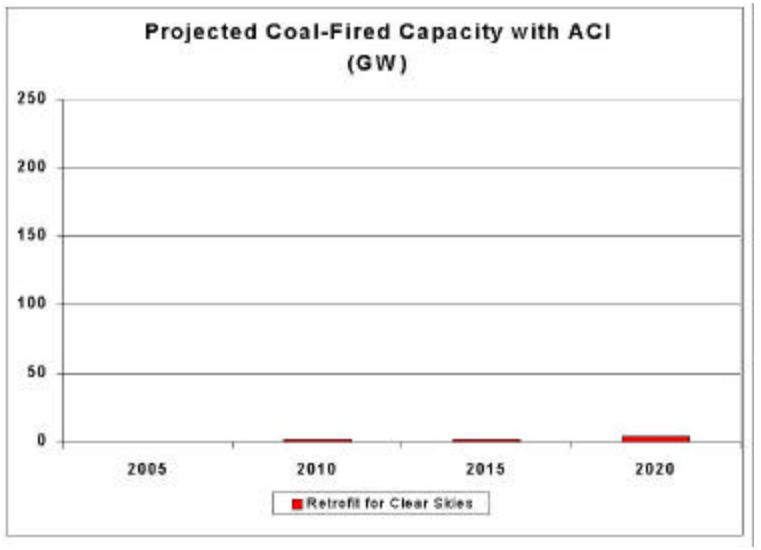
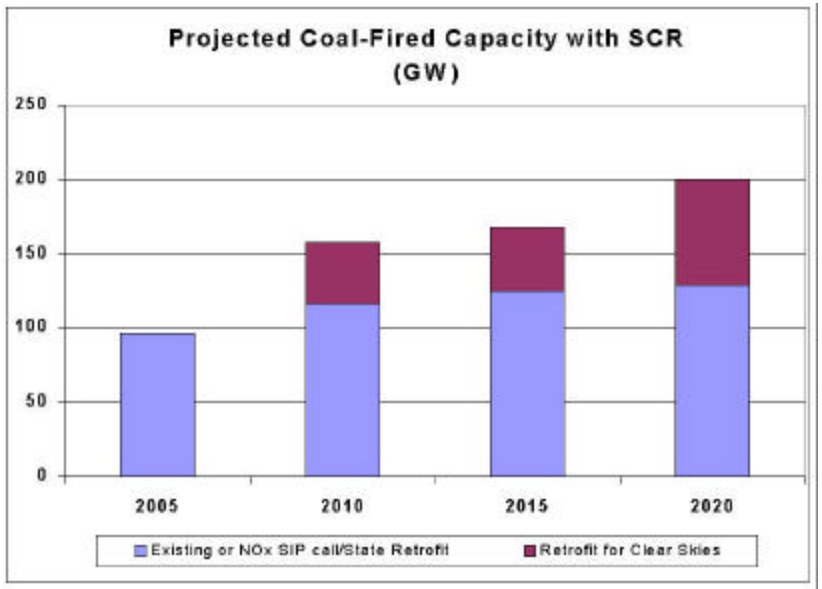
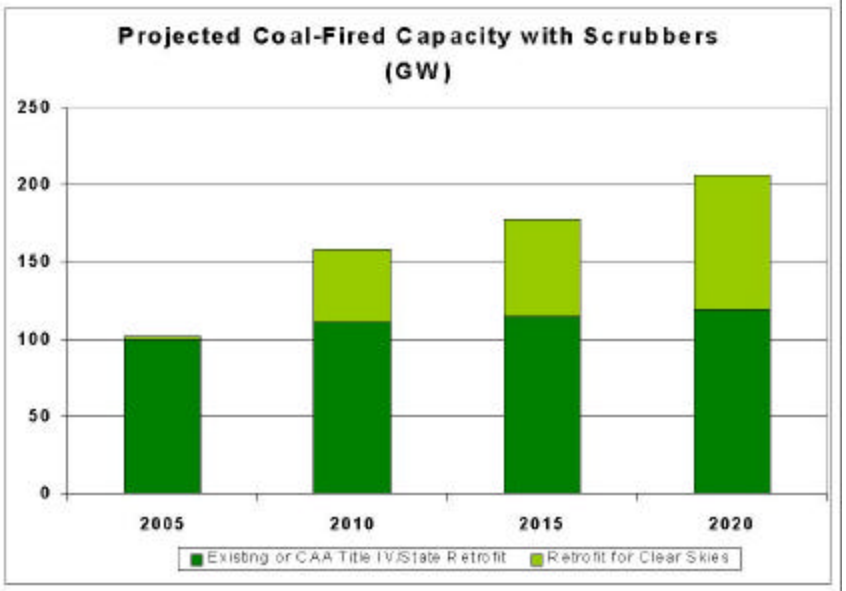
Projected Coal Capacity with Further Emissions Controls

- In 2020 with Clear Skies, 81% of all coal-fired capacity is projected to have one or more of the following: selective catalytic reduction (SCR) for NOx, flue gas desulfization (scrubbers) for SO_2, and/or activated carbon injection (ACI) for mercury. Of this capacity, 34% is due to Clear Skies. There will be about 300 GW of coal-fired units in 2020.
- Graphics show cumulative capacity with existing controls, controls projected to be retrofitted under the NOx SIP call, NSR settlements and state enacted programs, CAA Title IV, and controls projected to be retrofitted with Clear Skies.







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Units Repowering and Uneconomic to Maintain Due to Clear Skies

- The IPM model can determine that specific generating units are uneconomic to maintain, based on their fuel, operating and fixed costs, and whether they are needed to meet both demand and reliability reserve requirements.
- In practice, units projected as uneconomic to maintain may be "mothballed“, actually retired, or kept in service to ensure transmission reliability in certain parts of the grid. Our modeling is unable to distinguish between these potential outcomes.
- “Repowering” converts units to combined-cycle natural gas or IGCC.

COAL

- Relative to the Base Case, Clear Skies modeling is projecting that about 5.2 GW of coal-fired capacity will no longer be economic to maintain and that over 100 MW will repower to natural gas.
  - 54 units at 30 different coal plants are projected to be uneconomic as a result of Clear Skies.
  - Most of these units are a part of larger plants which include multiple units that are expected to keep generating. Only four plants are projected to have all of their units uneconomic to maintain, and only one of these is larger than 110 MW.
  - The uneconomic units are not concentrated in one or two states – the state with the most uneconomic capacity has only 19% of the total.
  - Units < 100 MW are 45% of the uneconomic coal unit capacity and 88% of the units.

Coal Units (GW)	Uneconomic	Repowering
Base Case	1.0	0.0
Clear Skies	6.2	0.1

Note: All uneconomic determinations take place in 2005, repowerings to natural gas in 2010

Units Repowering and Uneconomic to Maintain Due to Clear Skies

OIL/GAS STEAM

- Clear Skies is expected to result in slightly less oil/gas steam units which are uneconomic to maintain and about the same level of repowering relative to the base case.

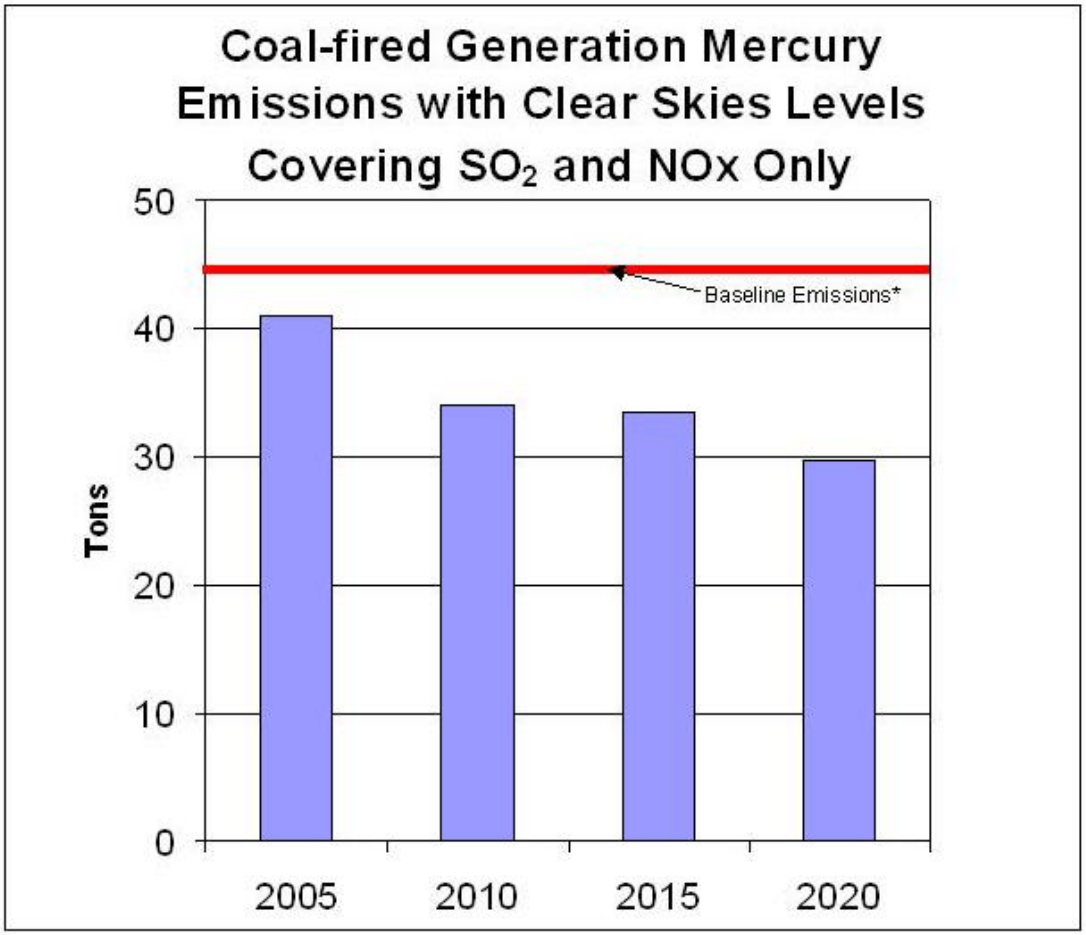
Oil / Gas Steam Units	Uneconomic		Repowering			
(Cumulative GW)	2005	2010	2005	2010	2015	2020
Base Case	30.7	30.7	0.0	2.1	4.1	4.1
Clear Skies	29.1	29.1	0.0	2.3	3.8	4.1

EFFECT OF OVERBUILD

- The uneconomic coal plants are a consequence of the overbuild of new gas-fired combined cycle plants since 2000. A sensitivity analysis run assuming optimal capacity builds from the year 2000 (rather than the overbuild) projects no coal capacity as uneconomic to maintain.
- Without the current overbuild, significantly fewer oil/gas steam units are uneconomic to maintain and many of those originally deemed uneconomic in 2005 would be repowered in 2010.

Sensitivity w/o overbuild	Uneconomic		Repowering			
(Cumulative GW)	2005	2010	2005	2010	2015	2020
Oil / Gas Steam Units	0.9	2.1	0.0	17.1	20.7	20.7
Coal Units	0.0	0.0	0.0	0.1	0.0	0.0

Co-benefits Emissions



*Baseline mercury emissions are projected to decline from 48 tons in 1999 to 45 tons in 2004 after implementation of Title IV and the NOx SIP call.

- In 2010, mercury emissions are projected to be reduced to 34 tons based on the mercury emission reductions that will occur from the emission controls plants will install to meet the SO_2 and NOx caps.
- In 2010, an additional 1 GW of scrubbers and 3 GW of SCR is projected with Clear Skies to comply with the mercury cap; these retrofits are not projected under a policy scenario that covers SO_2 and NOx only.

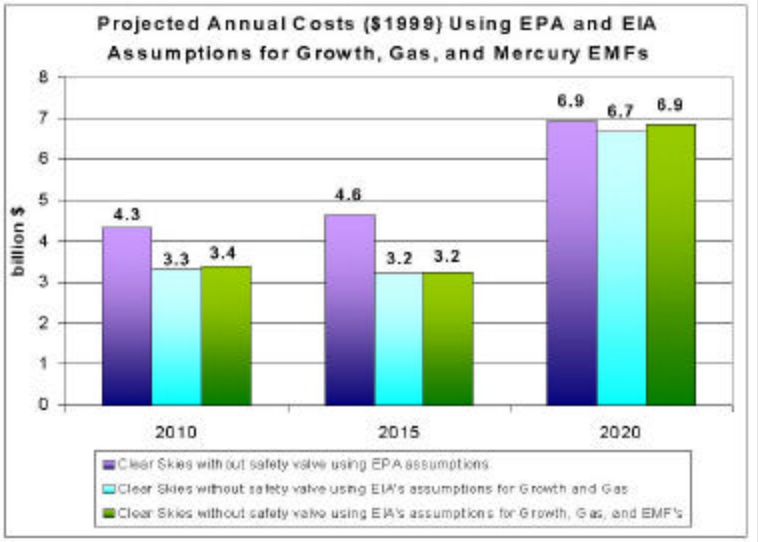
Note: The analysis presented represents EPA's estimates. EIA's modeling would likely show different impacts.

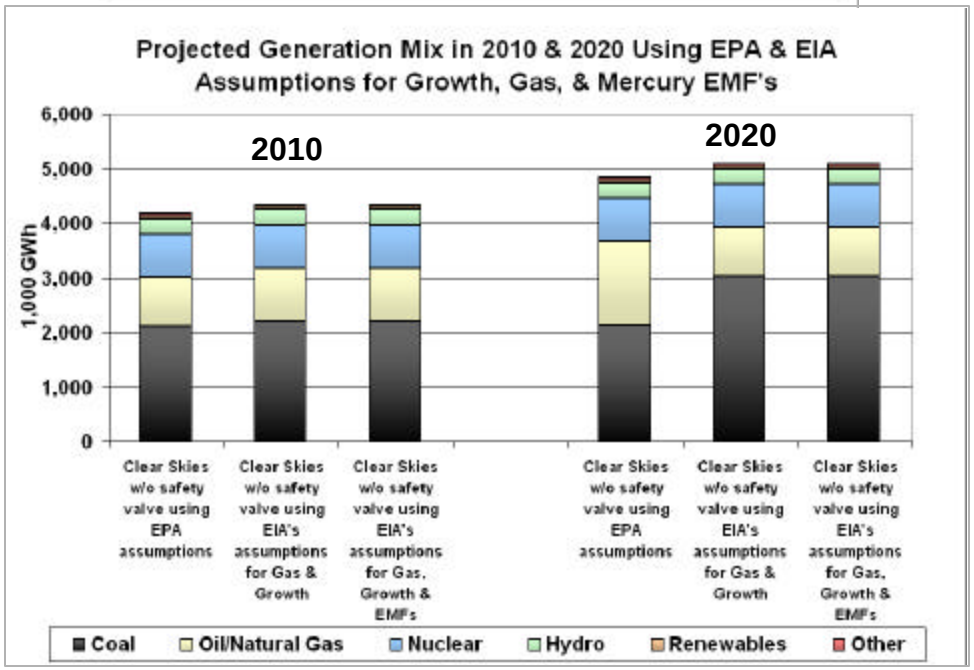
Impact of Changes in IPM Modeling Assumptions

- **EPA has explored the impact of changing assumptions in the model to:**
  - AEO 2003 natural gas prices
  - AEO 2003 electricity growth
  - Mercury emission modification factors (EMFs) used by EIA
- **To measure the pure impact of the assumptions, as opposed to the safety valve effect, a Clear Skies Case without the safety valve was used in IPM modeling of power grid behavior and emissions. With the safety valve modeled, the impacts would be smaller than those shown. (The sensitivity analysis did not extend to air quality and benefits analysis.)**
- **The assumptions used in the sensitivities for natural gas prices, electricity growth and mercury removal efficiencies were those used by EIA in its 2003 modeling.**

Effects of Assumptions for Natural Gas Prices, Electricity Growth, and Emission Modification Factors (EMFs)

- Projected annual costs decline or remain about the same when the model is run with EIA's natural gas assumptions, electricity growth assumptions, and/or EMFs. Assumptions lead to building much cleaner new coal-fired capacity that leads to lower overall cost.
- Annual costs increase less than 10% by 2020.
- Coal-fired generation increases.
- Allowance prices are relatively close, except for mercury.





Effects of Assumptions for Natural Gas Prices, Electricity Growth, and EMFs