Cinergy Modeling Analysis
Mercury MACT and CAIR

Presentation to US EPA

August 3,2004

Key Modeling Assumptions

Category	EPA (v.2.1.6)	Cinergy
Source	EPA Assumptions Updates v.2.1.6, July 2003	Cinergy Assumptions Document 02.03.04
Energy and Peak Demand	1.55% Demand and Peak Growth	ICF Energy and Peak Demand Growth Assumptions 2.3% Demand Growth, 2.2% Peak Growth
SO2 Control Cost and Performance (Wet FGD)	500MW = $201/kW	500MW = $276/kW (+adders for MACT and timing)
NOX Control Cost and Performance (SCR)	500MW = $80/kW	500MW = $194/kW
SO2 and NOX Controls for Mercury	SCR+FGD average 90% Hg cobenefit (bit)	Existing FGD - SCR+FGD 80% Hg Reduction for non Cinergy units. SCR+FGD 85% Hg Reduction for Cinergy units New FGD retrofits - SCR+FGD 85% Hg cobenefit (bit with CESP)
Mercury Control Cost and Performance (ACI + Fabric Filter)	500MW ~ $55/kW	500MW = $95/kW
Reference Gas Price Forecast	2005-$2.89, 2010-$2.97 2015-$2.96, 2020-$2.94	2005-$3.92, 2010-$3.66 2015-$3.49, 2020-$3.54
PRB Fuel Switching	$50/kW adder	Capital, FO&M, and VO&M PRB adders into 3 separate size categories. Additional Adders for heat rate penalty and 5 yr ammortization (ammortization CSA only)
CCR and Discount Rates	DR = 5.34%, CCR = 12.0%(retrofits)	DR = 7.1%, CCR = 13.6%(retrofits)

Cinergy Modeling Analysis of Mercury and CAIR

- Cinergy used IPM to analyze the economic and environmental impact of potential CAIR and mercury policies.
- The medium to long term projected economic and environmental impact of these rules depend greatly on the assumptions and the accurate reproduction of the first few years (2004- 2008) of how the industry will likely respond.
- Cinergy used current real world cost and performance information of fuel market, energy markets and pollution control markets in our analysis.
- Cinergy's forecast of energy demand is higher than EPA and is based on actual experience over the past 20 years.
- Cinergy's pollution control retrofits costs are significantly higher since EPA is using out of date hardware costs, building code factors and labor costs.
- EPA's assumptions regarding fuel switching to PRB are too simplistic given recent experiences and implications of MACT rule.
- EPA's cost of capital assumptions are too low, and do not reflect actual costs.
- EPA's has not factored in a compliance safety margin into their MACT analysis.

Cinergy Modeling Analysis of Mercury and CAIR

CAIR and Mercury Trading Rule Results

- Based on this more accurate cost and performance information:
  - EPA's SO2, NOx and Mercury emissions in 2005 are modeled incorrectly. Emissions will not decrease in 2005 as EPA has predicted.
  - SO2 allowance prices are 70% higher on average than EPA
  - NOx allowances prices are 100% higher on average than EPA
  - SO2 emissions reductions are greater than EPA during 2010 – 2020
  - NOx emissions reductions are comparable or slightly less than EPA
  - Mercury co-benefit levels in Phase I would be higher than EPA projections.
- Cinergy forecasts comparable levels of FGD, SCR retrofits but many more SNCR retrofits due to higher allowances prices.
- Cinergy assumes larger demand for electrical power in the future which leads to much greater demand for natural gas which results in higher nat. gas prices.
- Cinergy results show lower bituminous coal consumption, and 25 % higher subbituminous and 10 % higher lignite coal consumption.
- Cinergy results show that the CAIR and Mercury trading policy would cost approximately 50% more on a 20 yr NPV basis as compared to EPA's results.

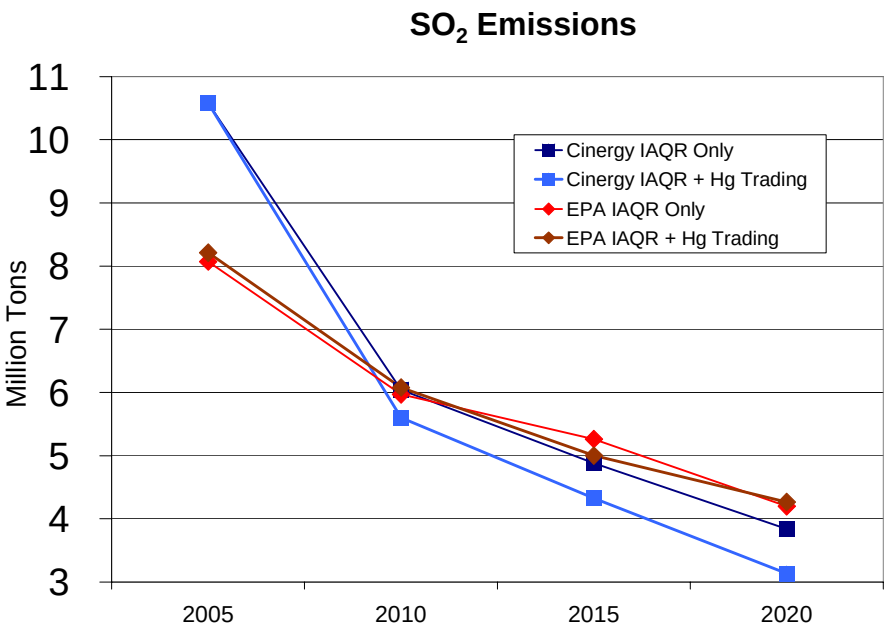
Cinergy Modeling Analysis of Mercury and CAIR

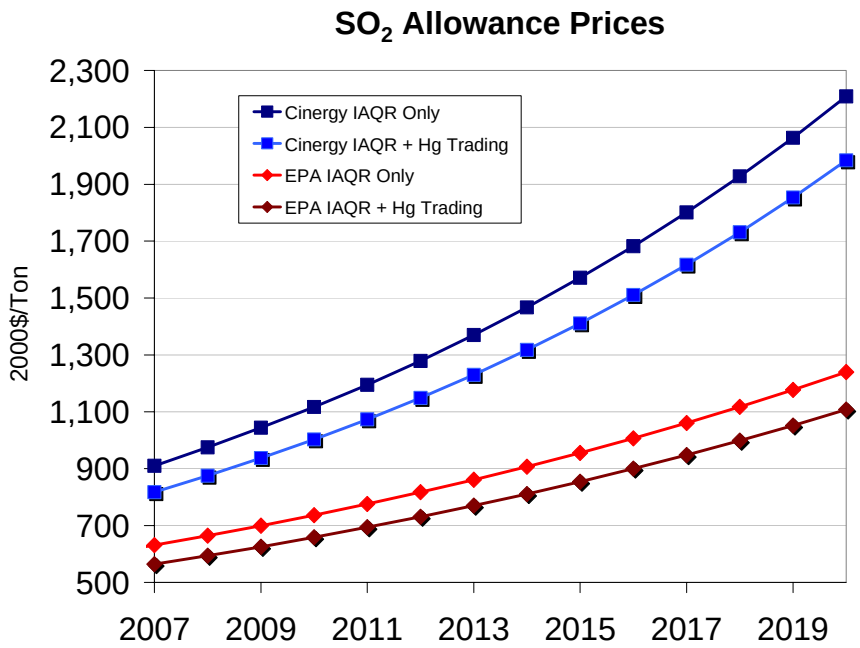
More Stringent Mercury MACT Rule Results

- Cinergy modeled the potential result of a very stringent MACT rule, and CAIR, on the industry using the following new mercury assumptions:
  - Mercury MACT compliance deadline of 2008
  - Uniform 0.88lb/Tbtu emissions rate on all coal ranks
  - ACI/PBH was not commercially available until 2010
- Due to the lack of ACI/PHB controls units had to switch to lower mercury coals, install FGD/SCR or shut down in order to achieve compliance.
- An unrealistic number of FGD/SCR were installed by 2008 in order to meet the MACT limit.
- This resulted in a glut of SO2 and NOX emission allowances being banked in early years and higher emissions in the later years.
- Units burning PRB are shut down for two years since no technologies existed until 2010 to comply with stringent MACT emissions limit.
- Natural gas and oil fired units were operated to make up generation short fall.
- This resulted in significant increases in power prices and fuel prices in short term.
- Once ACI/PBH became available units installed controls and started running.
- Overall cost of compliance (20 yr NPV) with this rule was twice that of proposed mercury trading rule.

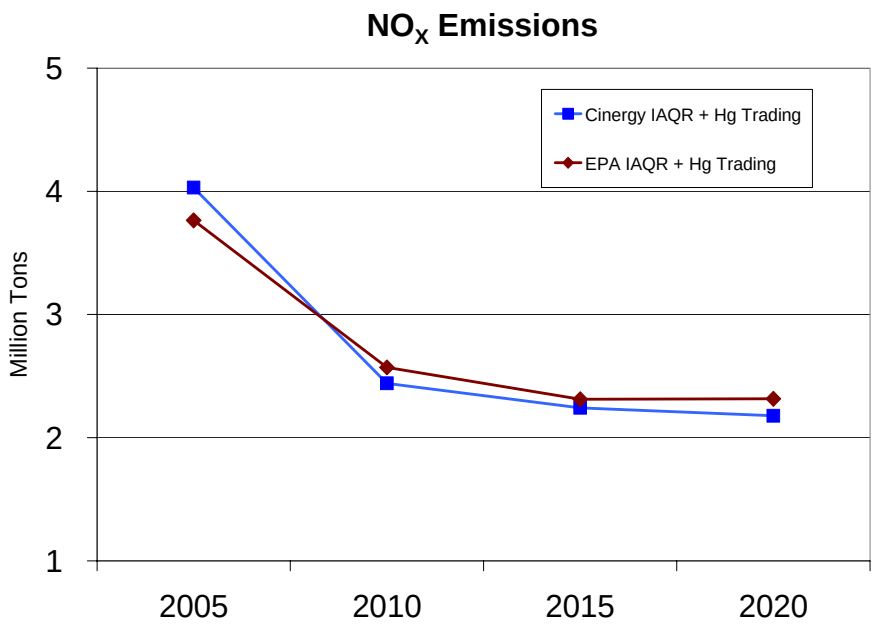
CAIR and Mercury Rule Modeling Results

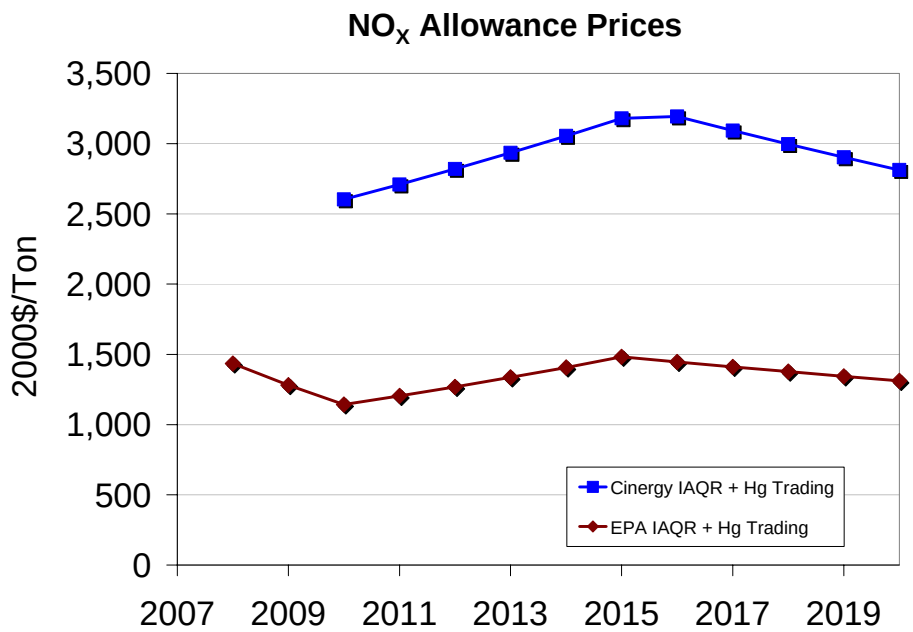
National SO_2 Emissions and Allowance Prices



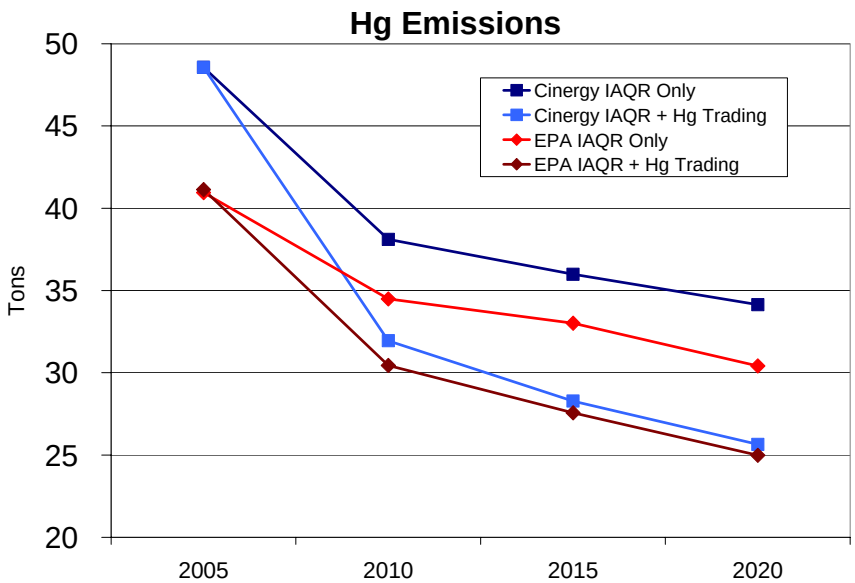


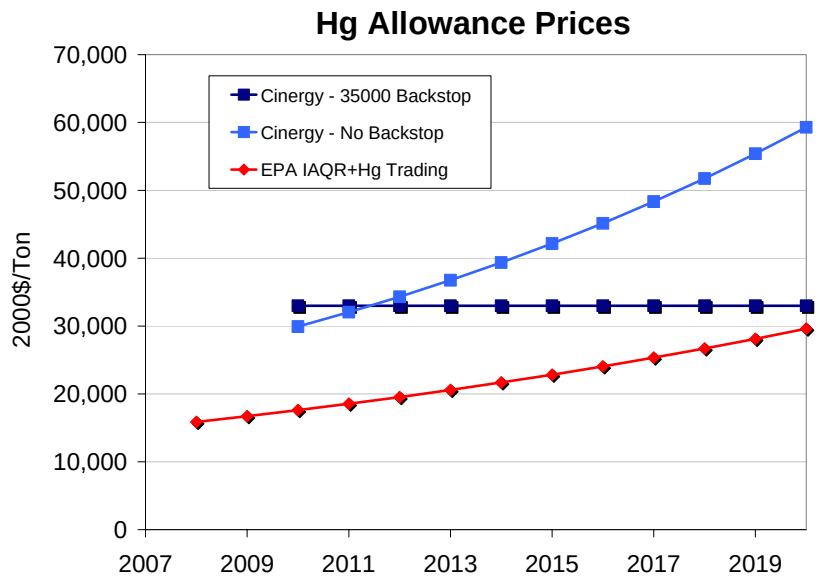
National NO_X Emissions and Allowance Prices





National Hg Emissions and Allowance Prices[1]

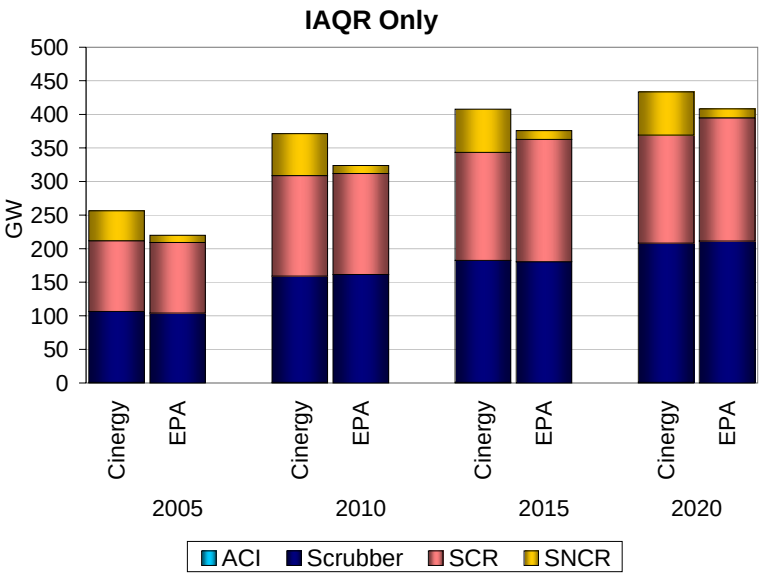


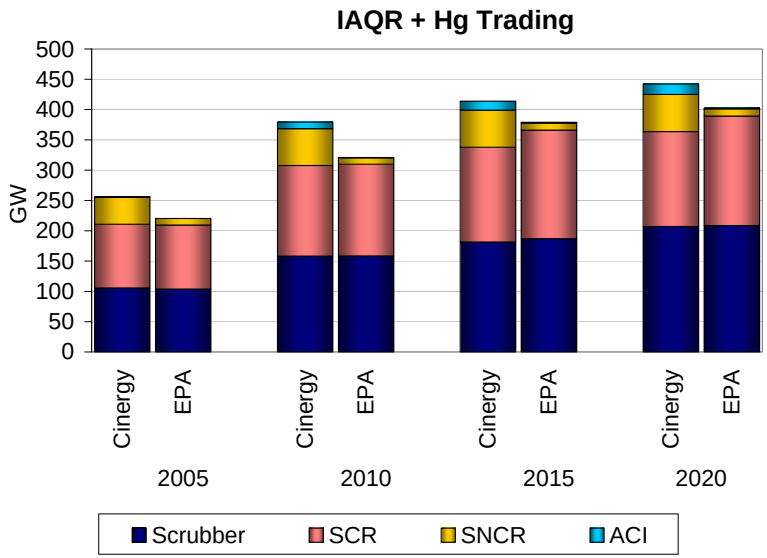


[1] Hg emissions shown are for affected units only.

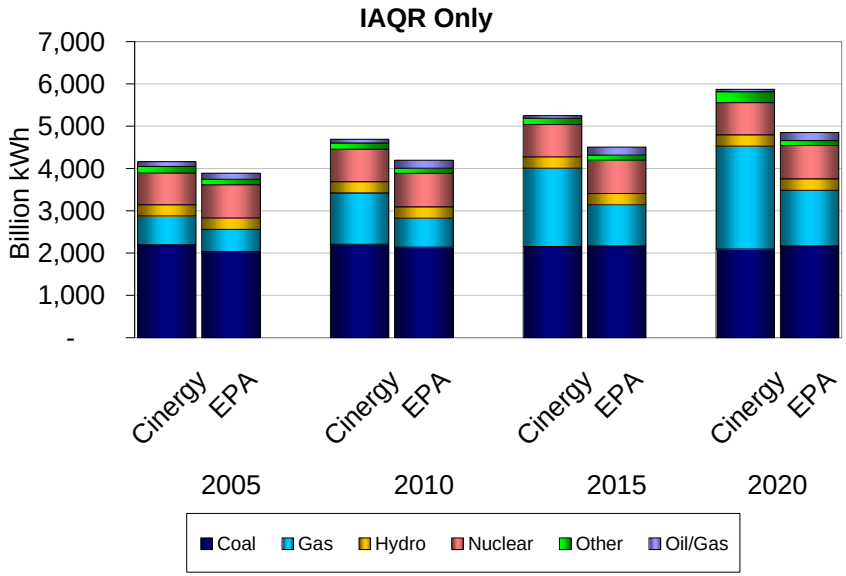
National Cumulative Compliance

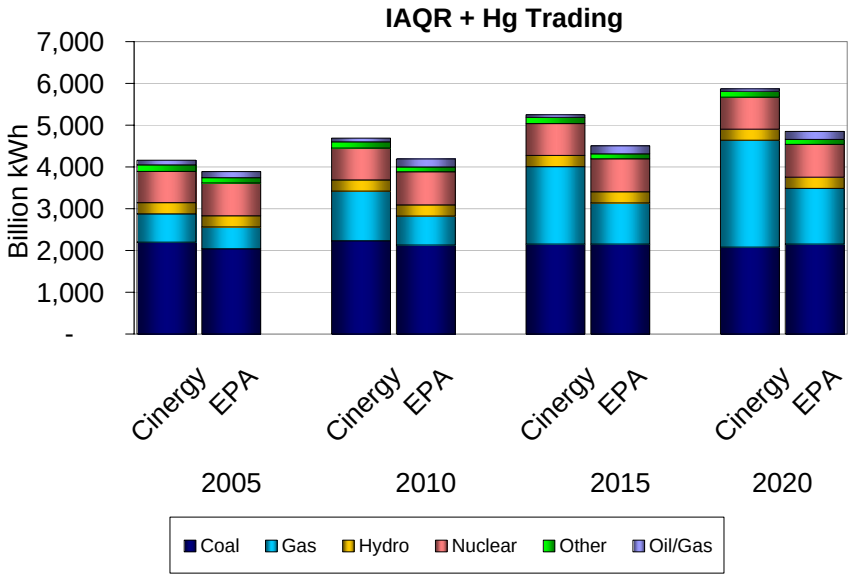
(includes existing controls)



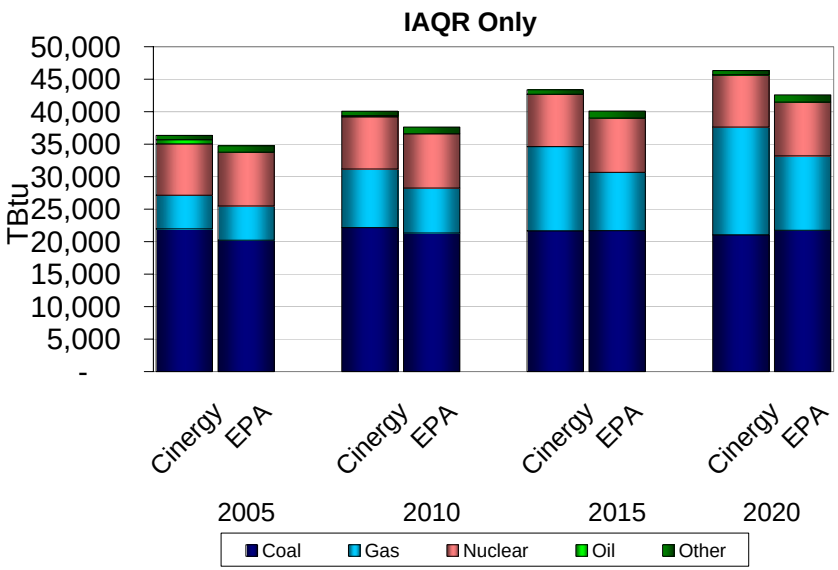


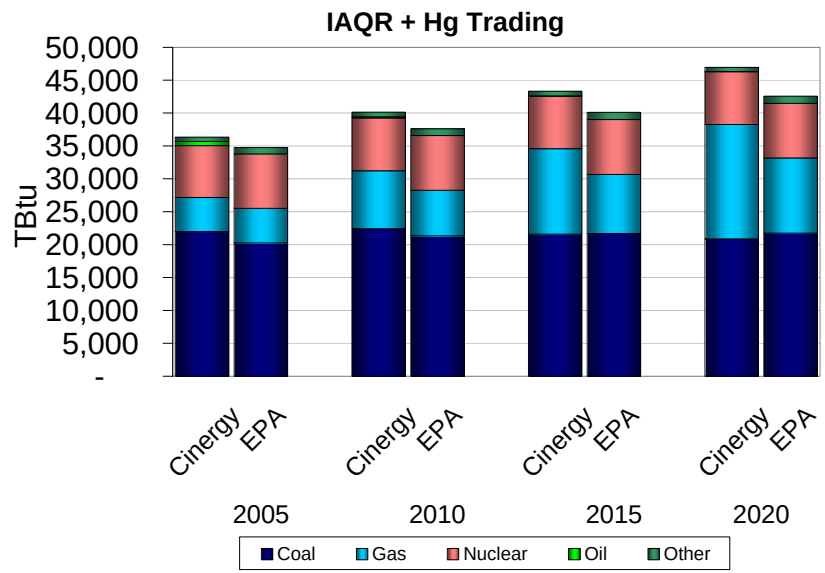
National Generation



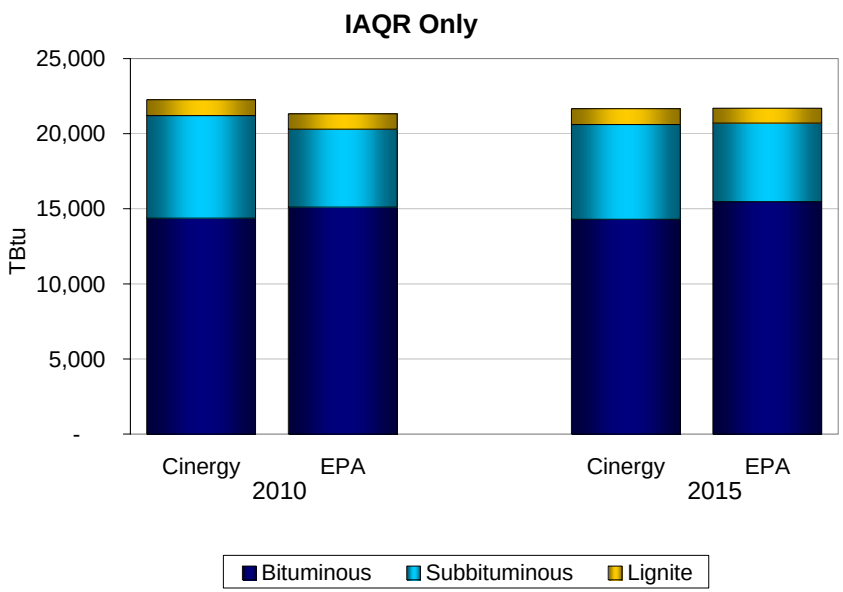


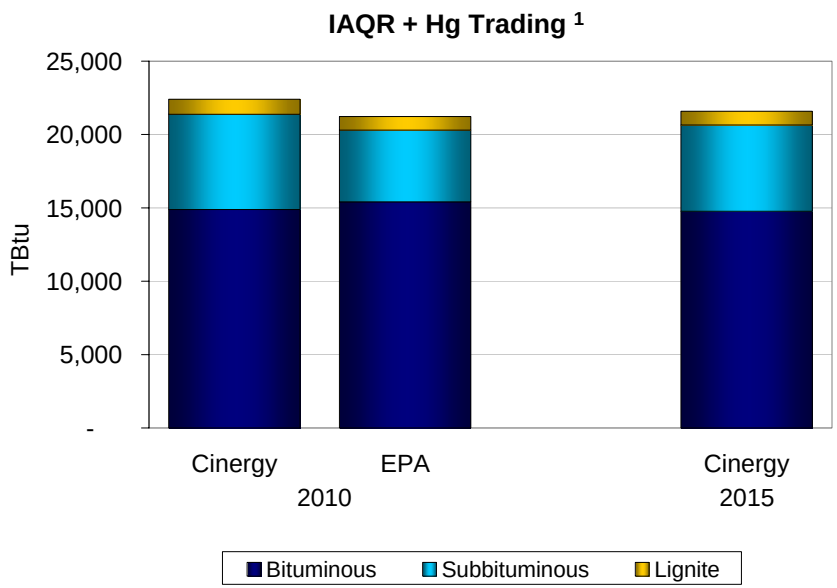
National Fuel Consumption





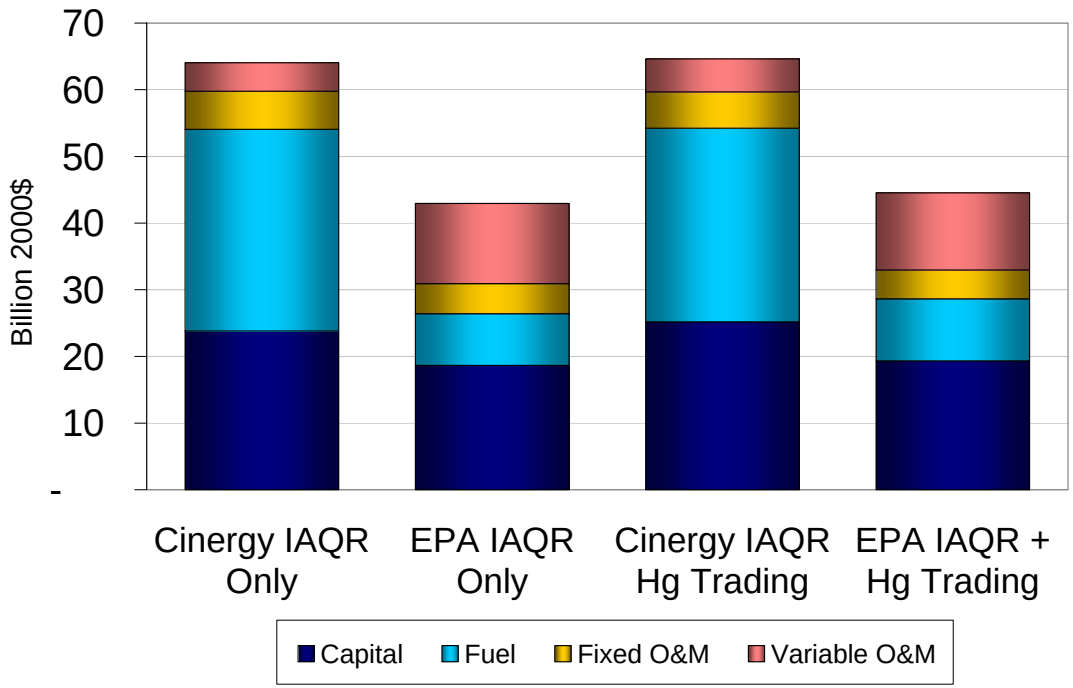
National Coal Consumption





[1] Note: EPA has only provided coal consumption for 2010 for the IAQR + Hg Trading Scenario

National System Costs – 20 Year NPV (Delta from Reference Case)

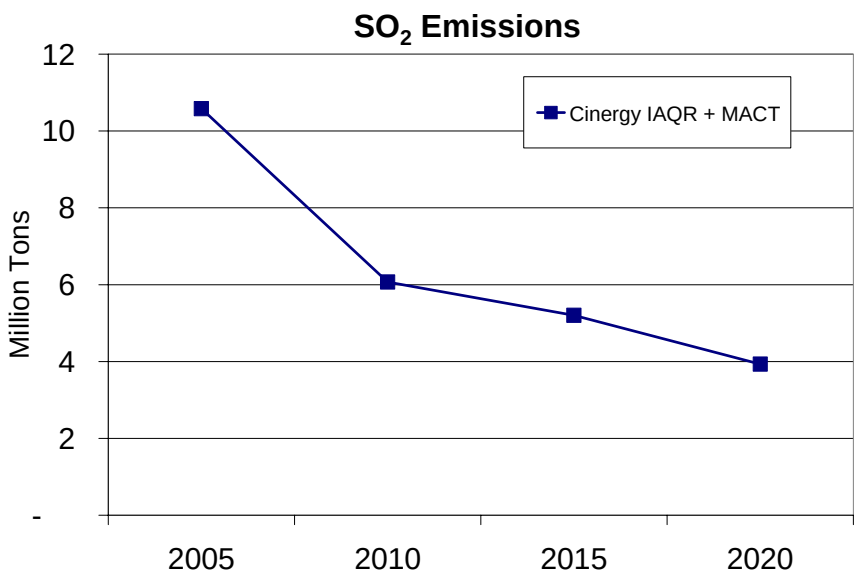


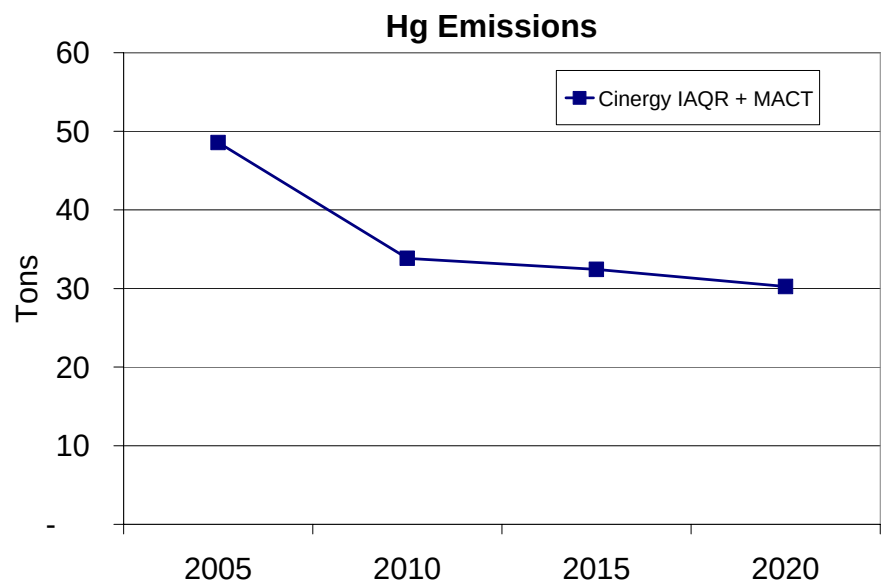
IAQR + Hg MACT Scenario

- The following series of slides show results from an IAQR + Hg MACT scenario that Cinergy analyzed. EPA did not release results of a comparable scenario.
- The Hg MACT scenario analyzed the emissions rates contained in the proposed Hg rule.

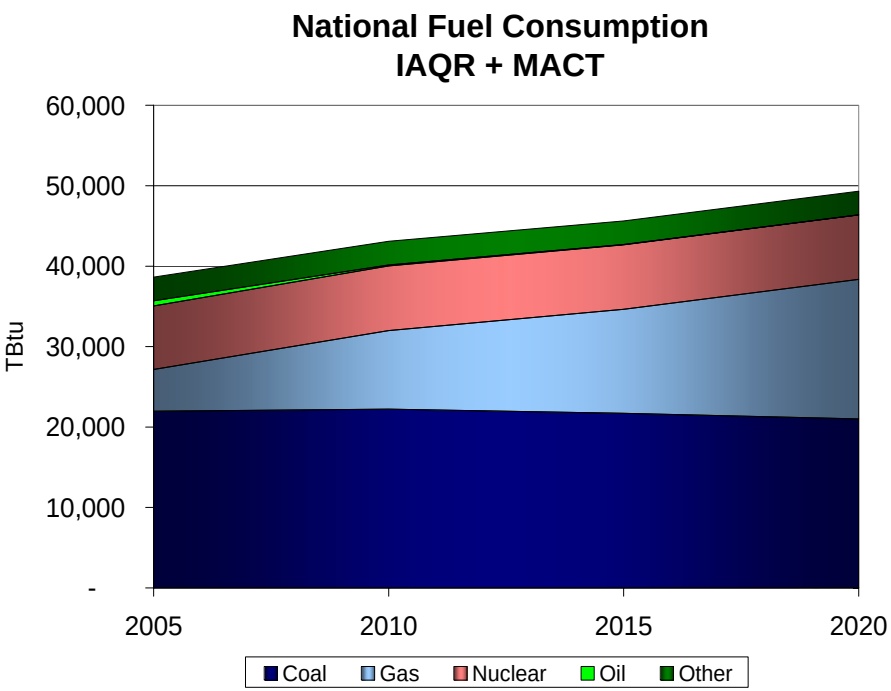
Bituminous	2.0 lbs/Tbtu
Subbituminous	5.8 lbs/Tbtu
Lignite	9.2 lbs/Tbtu

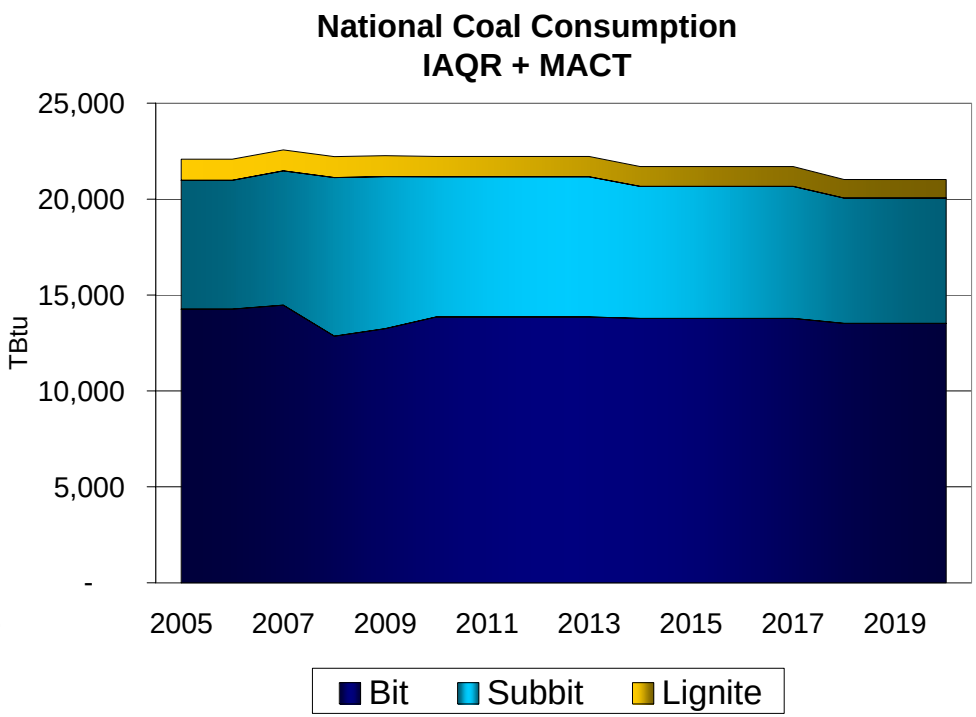
SO_2 and Hg Emissions
Cinergy IAQR + Hg MACT



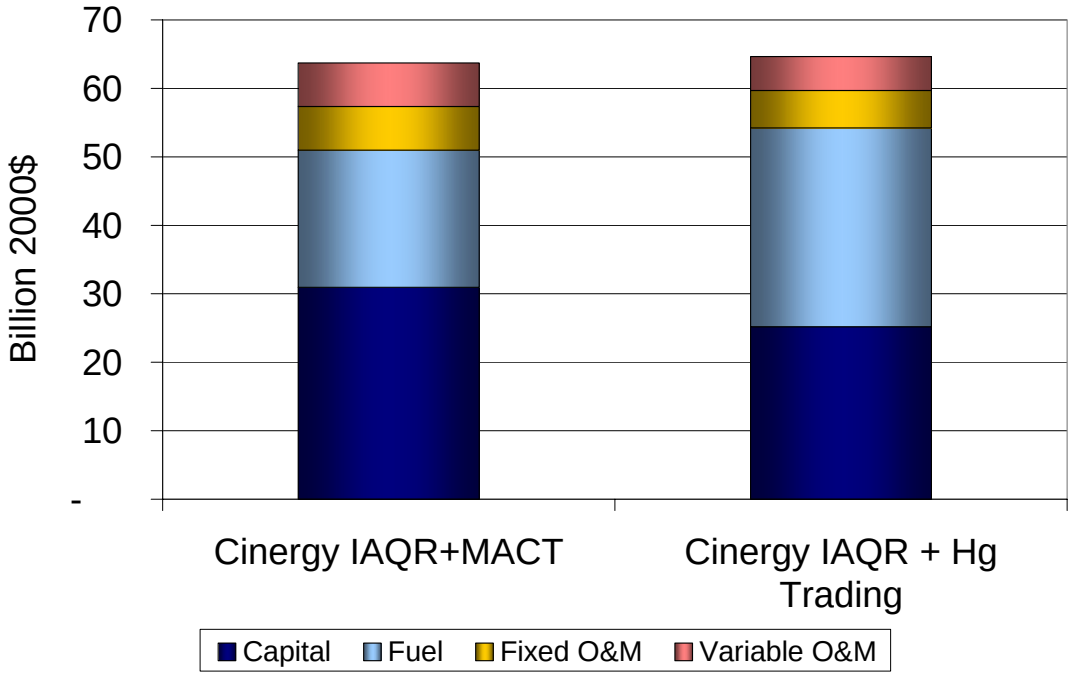


National Fuel and Coal Consumption
Cinergy IAQR + Hg MACT





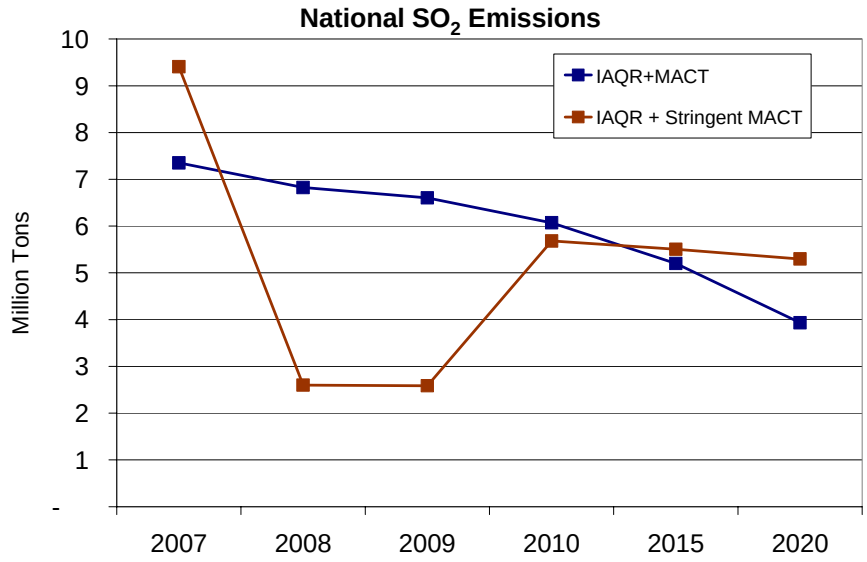
National System Costs – 20 Year NPV (Delta from Reference Case)

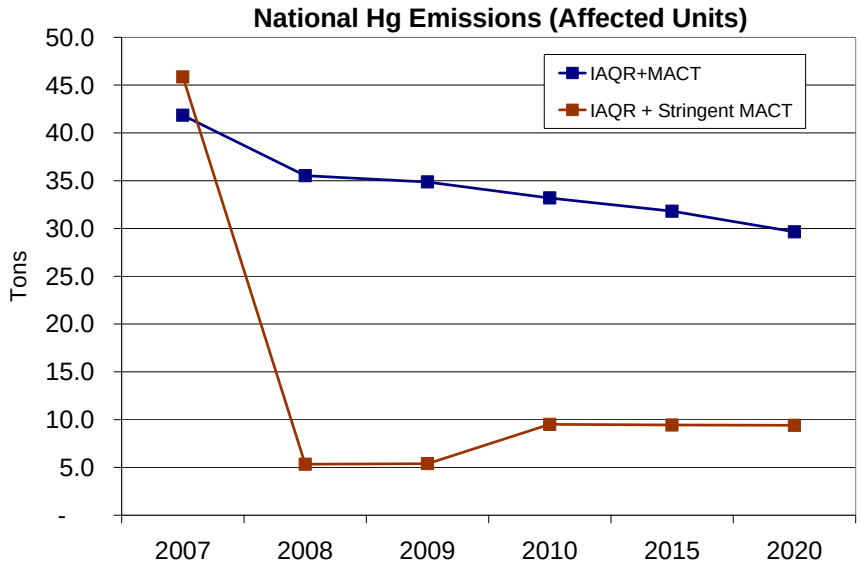


IAQR + Stringent Hg MACT

- In order to evaluate the impact of a more stringent command and control Hg MACT policy on the electric power system, Cinergy analyzed a scenario with no sub-categorization and a 0.88/lb/Tbtu rate for all affected units.
- This scenario was developed based on recommendations made by various environmental groups. However it is Cinergy's view that this is not a reasonable policy option.
- This rate produced the equivalent of approximately 9 tons of emissions for affected units.
- The Stringent MACT scenario starts in 2008, but it assumes that ACI is not commercially available until 2010.

Stringent MACT Scenarios – National SO_2 and Hg Emissions





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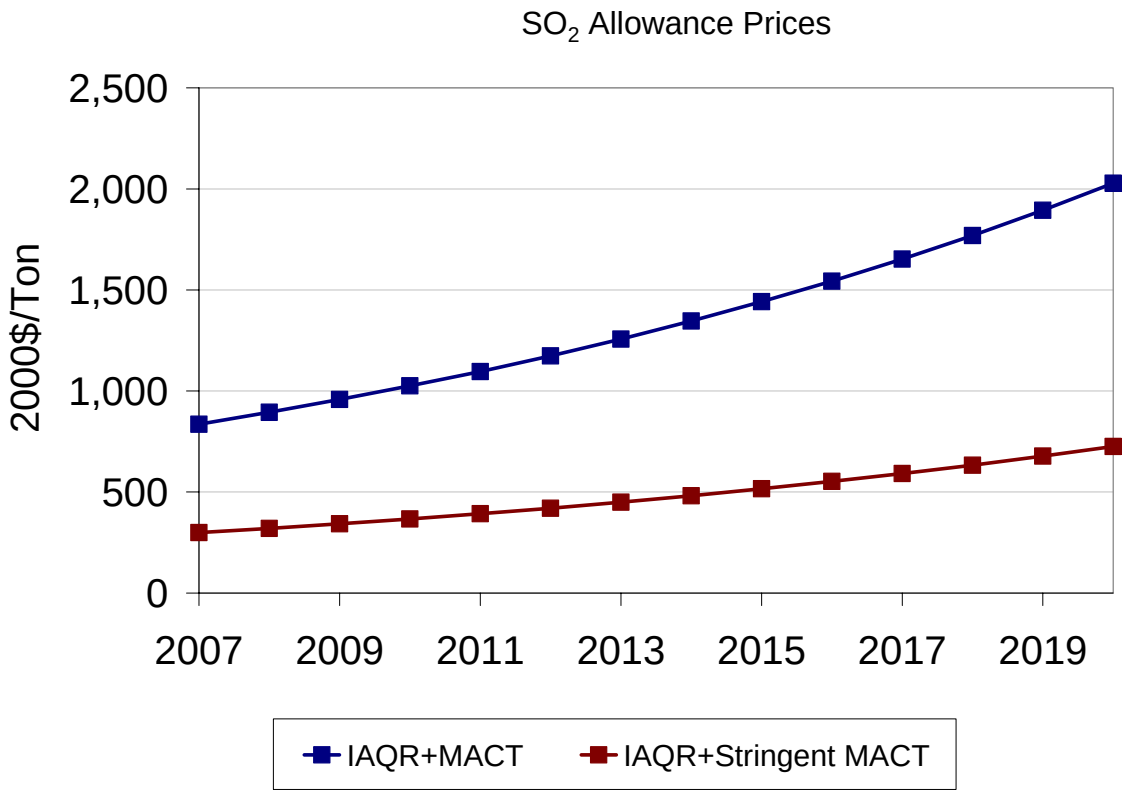
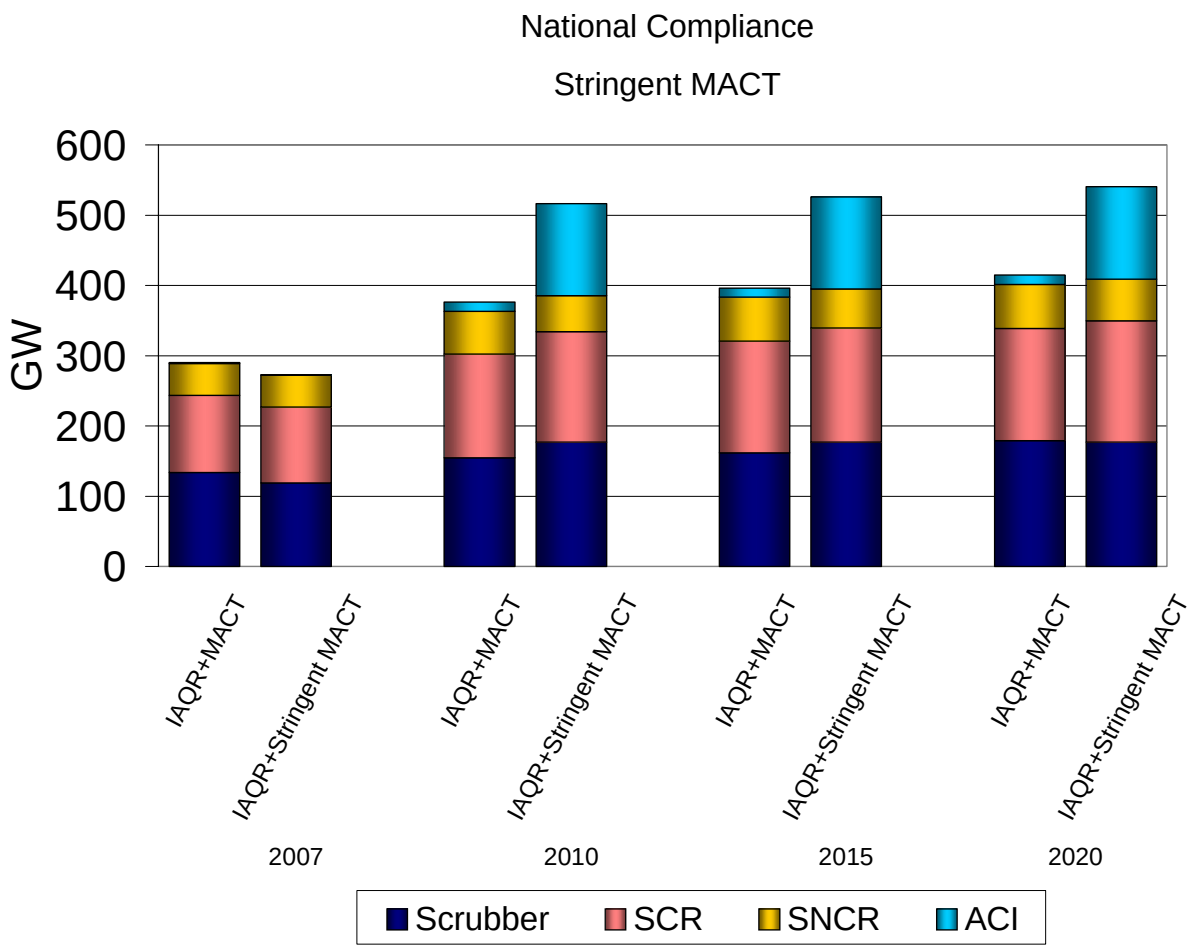
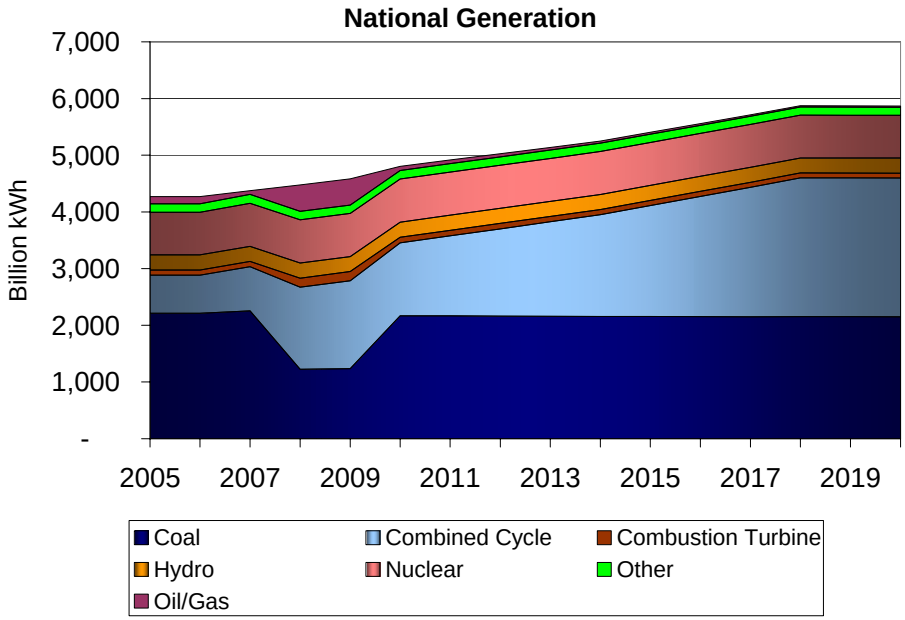
Stringent MACT Scenarios – National SO_2 Allowance Prices

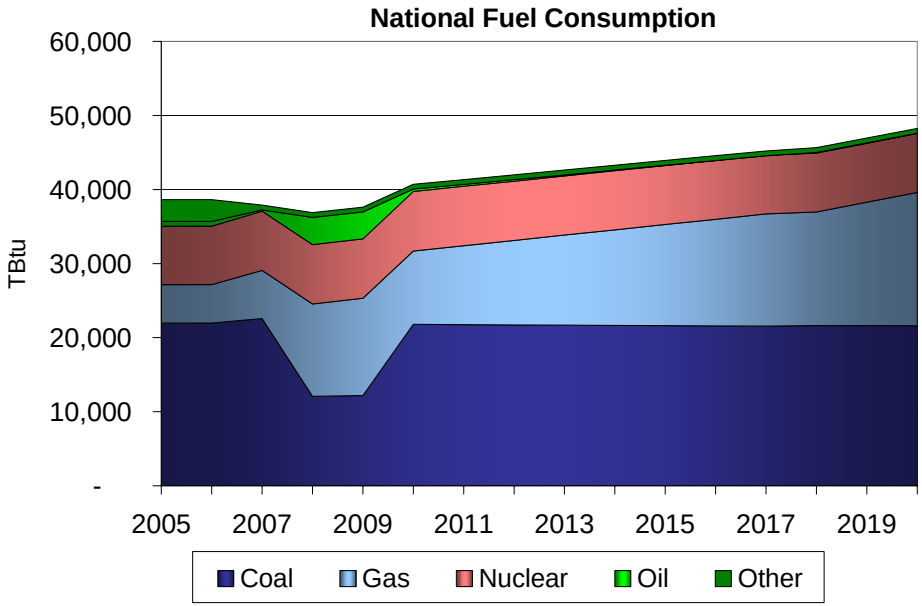


Stringent MACT Scenarios – National Cumulative Compliance



Stringent MACT Scenarios – National Generation and Fuel Consumption





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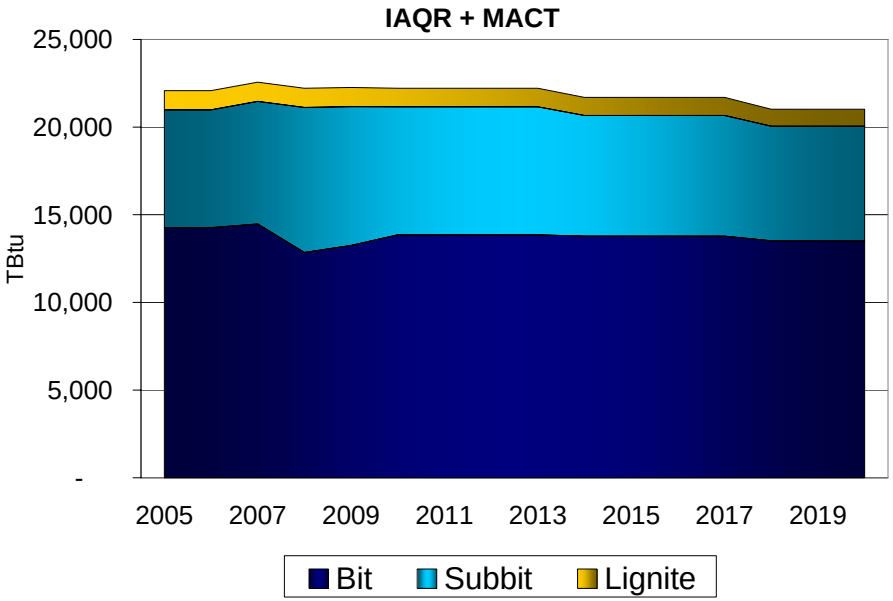
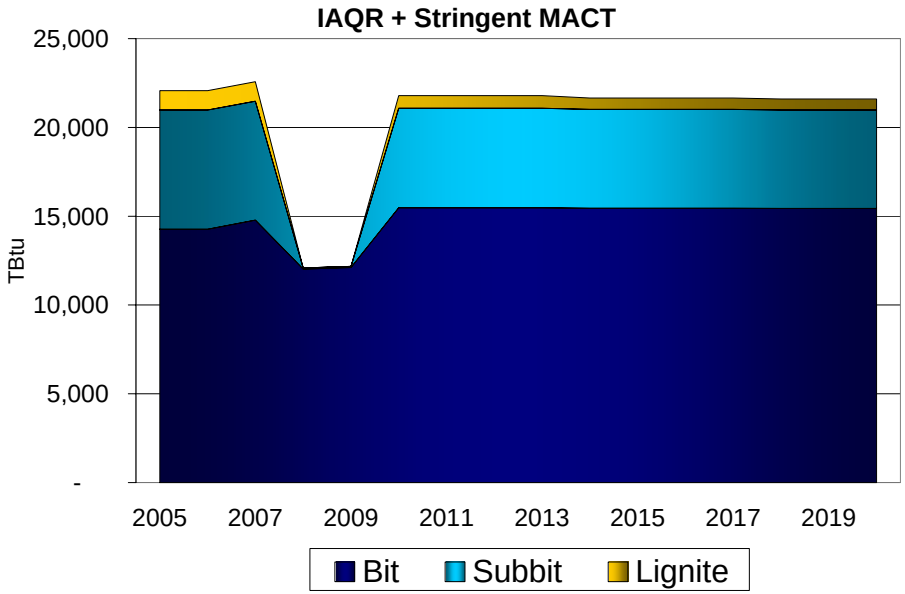
Stringent MACT Scenarios – National Coal Consumption





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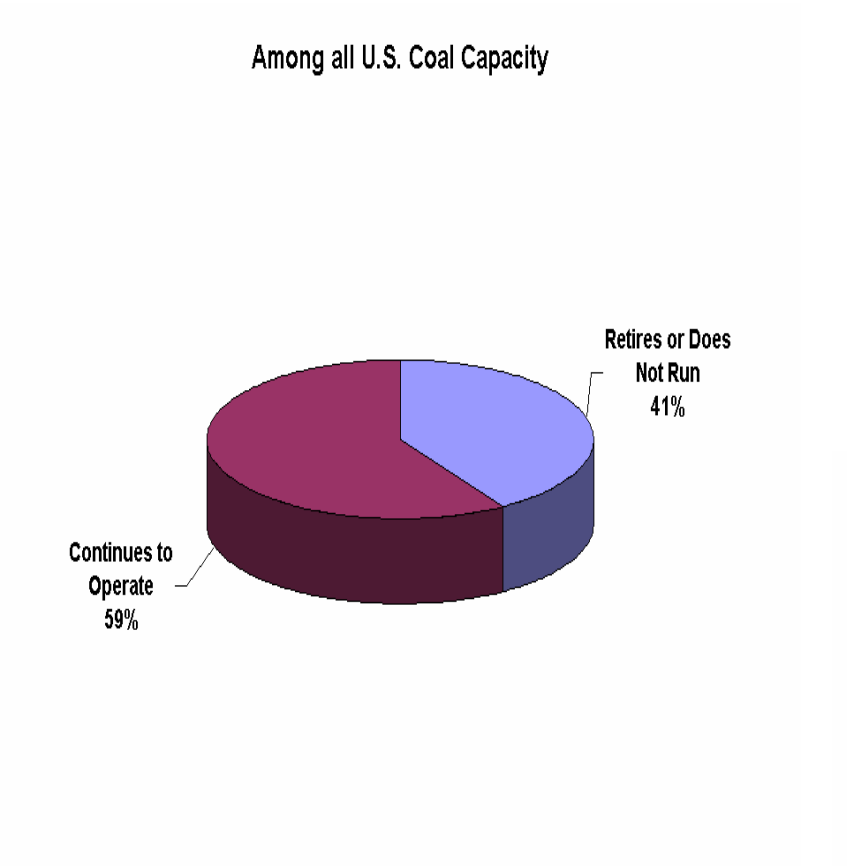
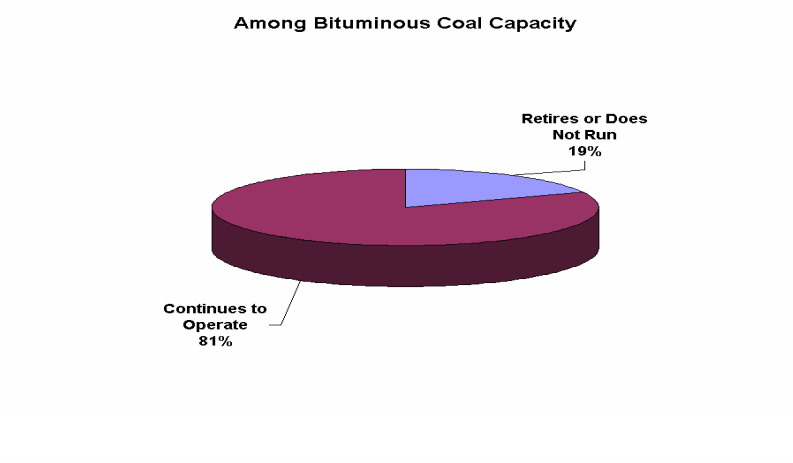
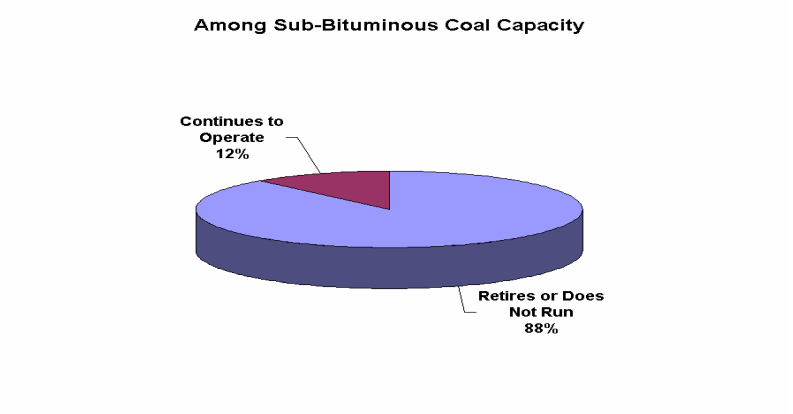
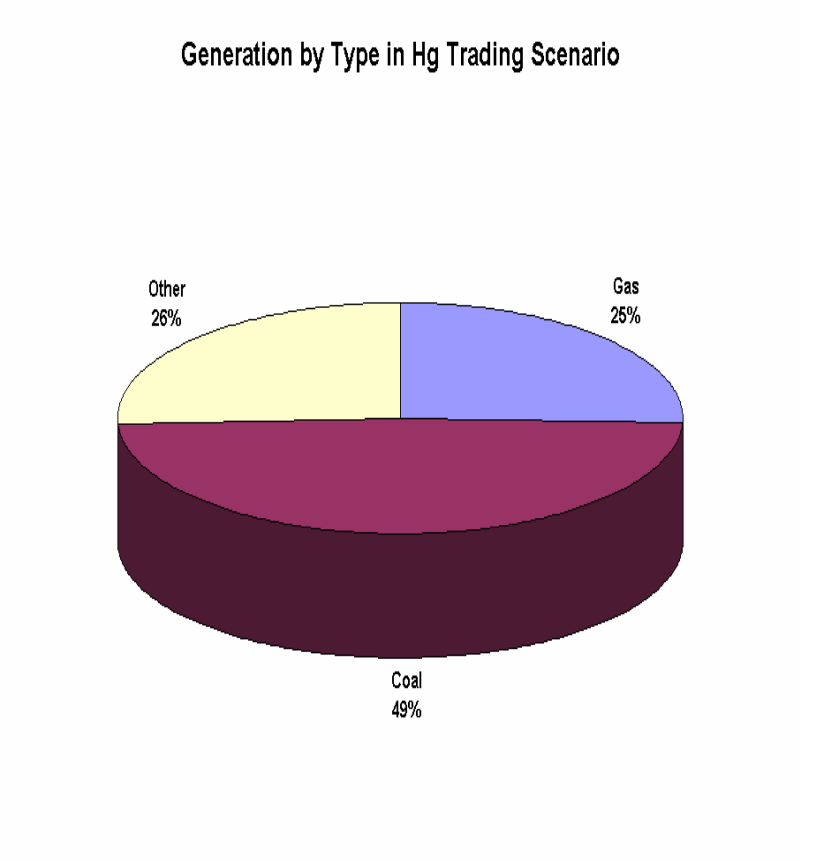
Much Coal Capacity Does Not Dispatch in 2008 and 2009

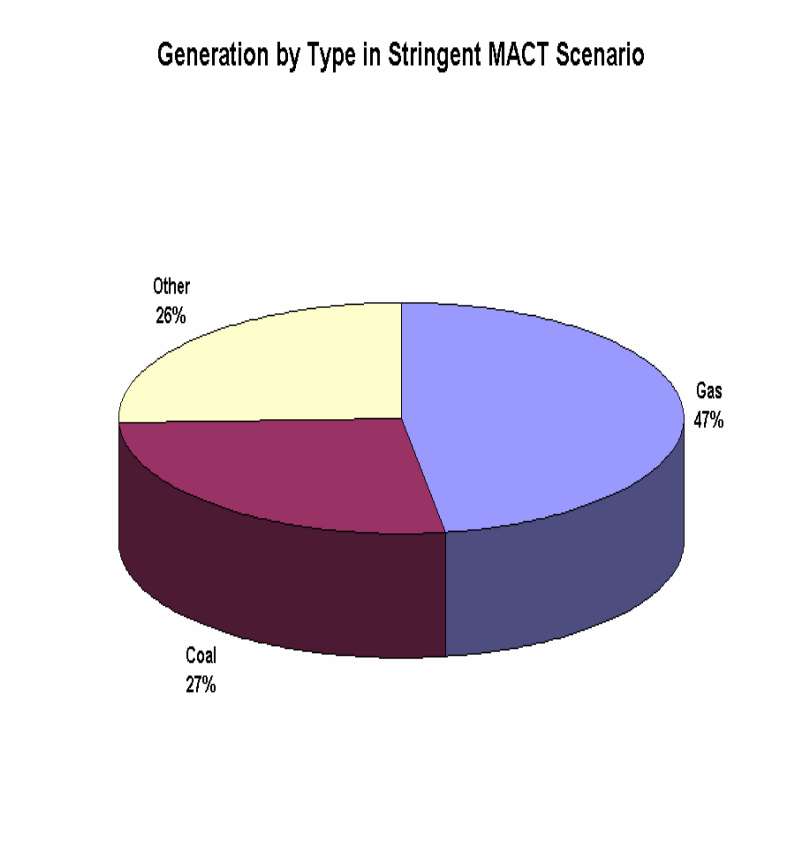






A Generation Deficit in 2008 & 2009 is Meanwhile Averted with Additional Dispatch From Gas Units



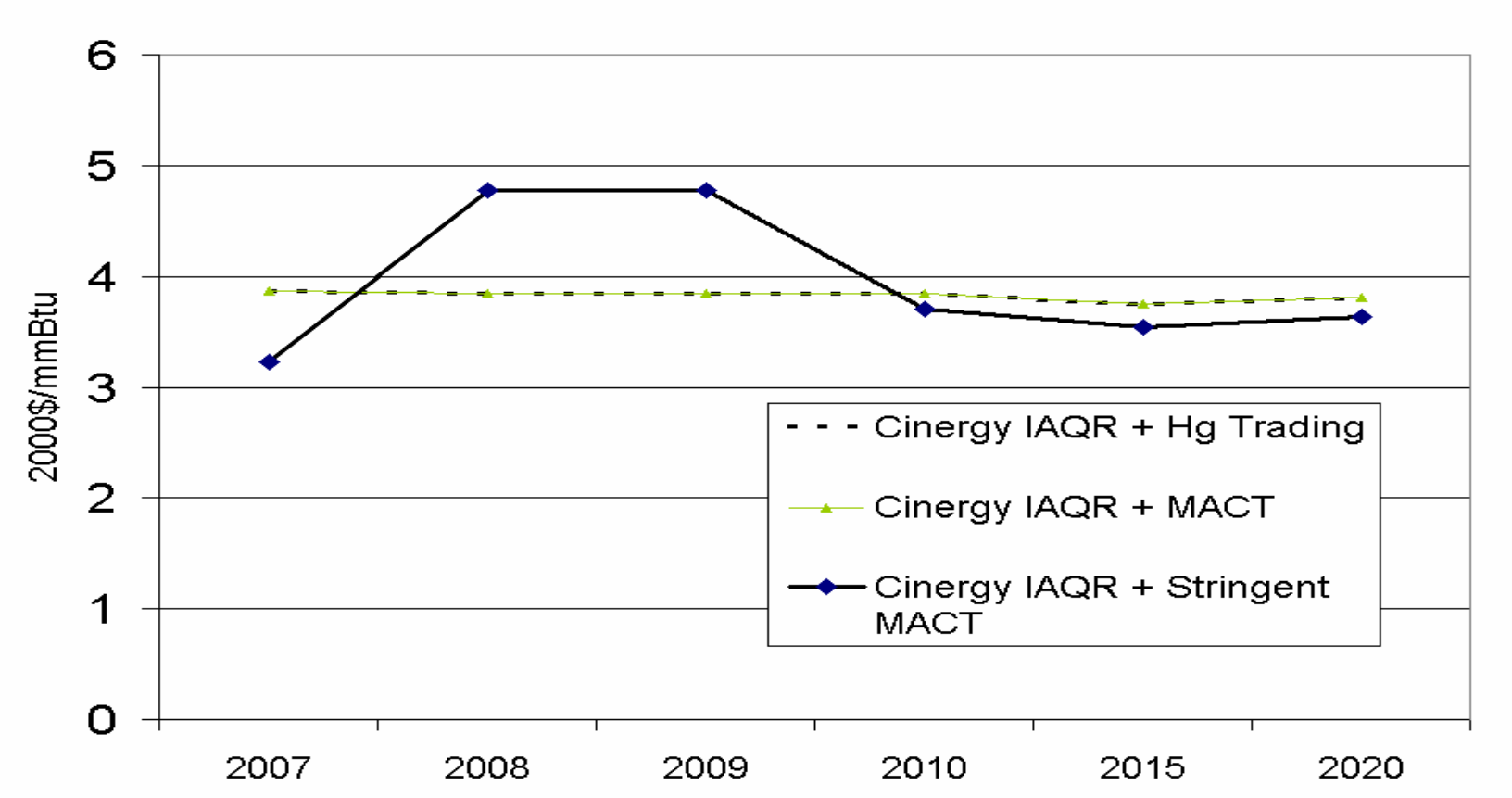


Annual Gas Demand in 2008 and 2009 Across the Hg Policy Scenarios

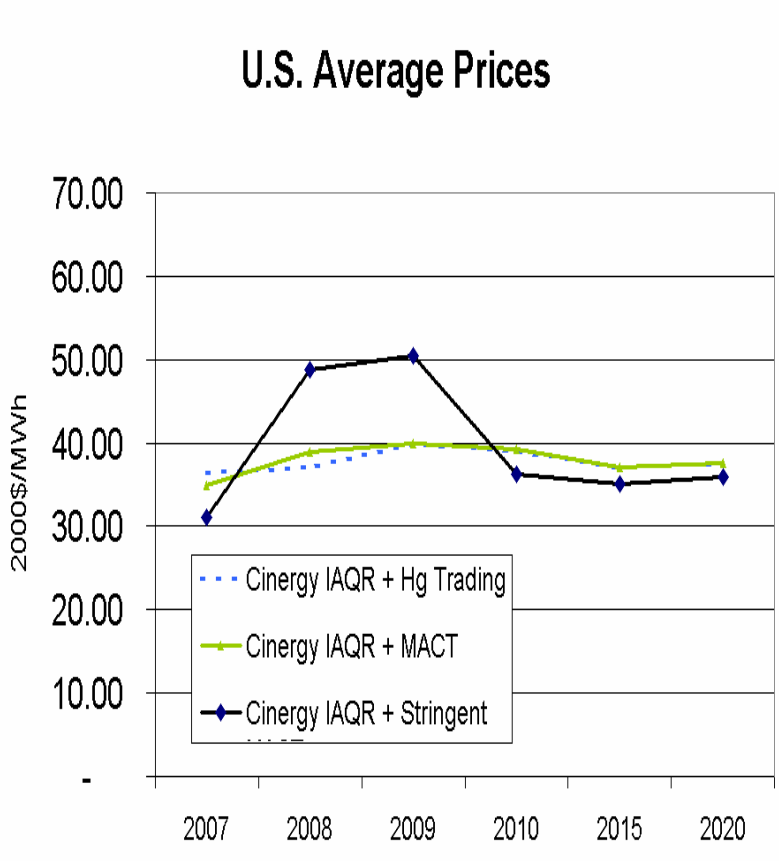
	Annual Gas Consumption at Electric Generators (TBTU)	Percent of Total U.S. Gas Consumption
IAQR + Trading	7,691	31%
IAQR + MACT	7,856	31%
IAQR + Stringent MACT	12,796	42%

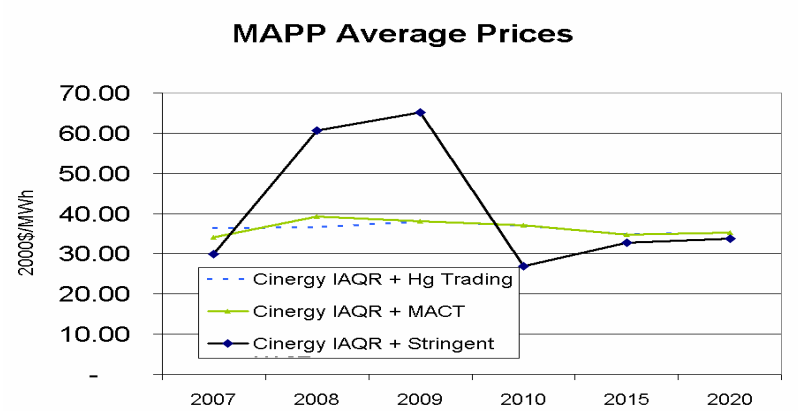
The forecast for U.S. gas consumption outside the electricity industry was provided by EIA in the AEO 2004. In 2008 and 2009 that demand was 17.47 quadrillion btu per year.

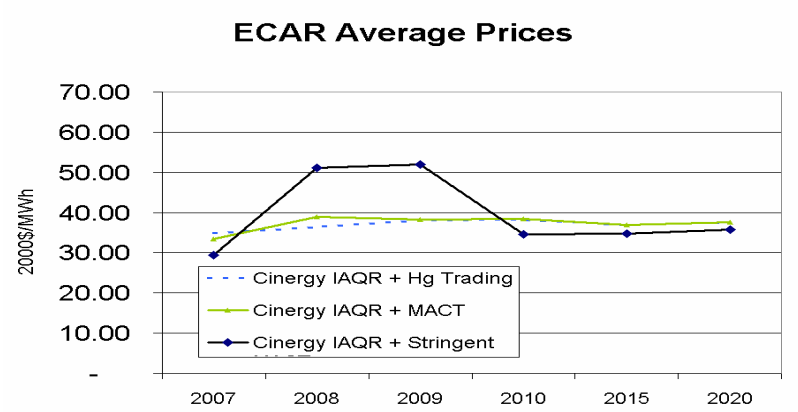
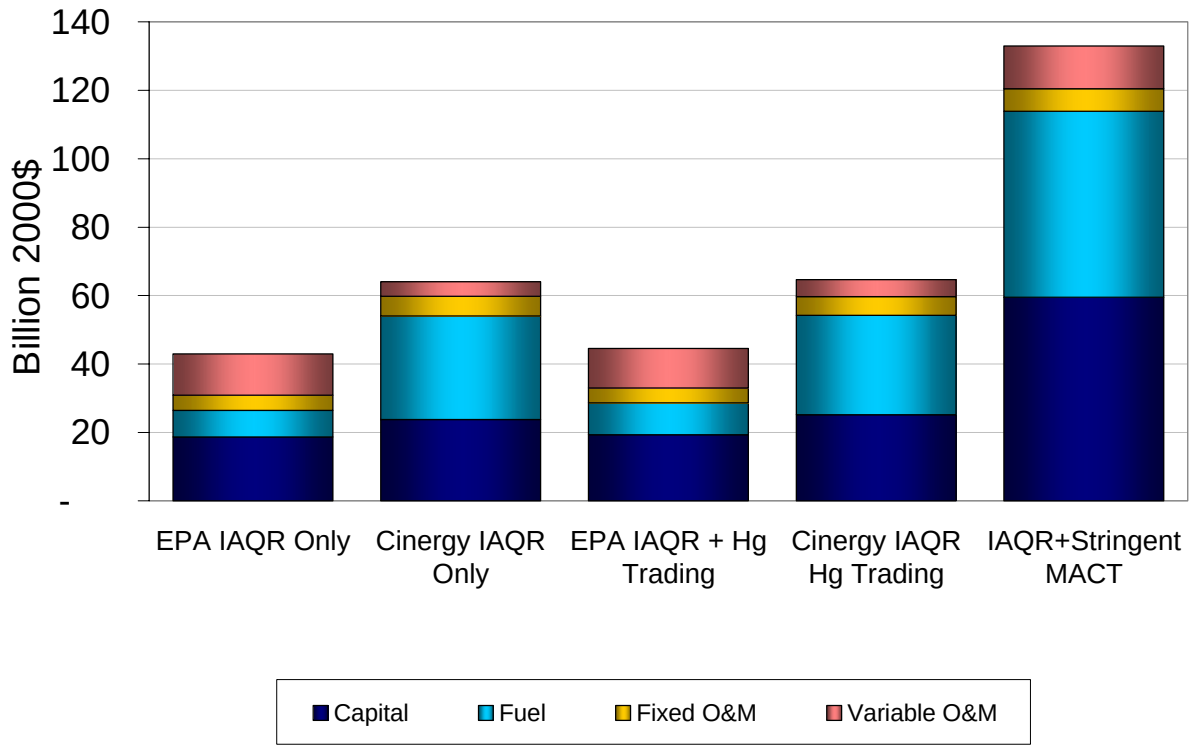
Gas Prices Across the Hg Policy Scenarios



Firm Power Prices Across the Hg Policy Scenarios







National System Costs – 20 Year NPV (Delta from Reference Case)