# Emission Reduction Strategies for the Electricity Sector and Their Impact

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### Multipollutant Policy in the Electricity Sector and Mercury Emissions

- Electricity is responsible for 40% of U.S mercury emissions.
- Federal multipollutant legislative proposals (Clear Skies, Clean Power Act, Clean Air Planning Act) include restrictions on mercury.
- At least 2 states regulate mercury emissions from electricity generators.
- EPA recently finalized two new controversial rules using a cap and trade approach:
  - Clean Air Interstate Rule (CAIR)
  - Clean Air Mercury Rule (CAMR)
- Many state officials are eager to see tougher restrictions on mercury emissions and a technology-based approach is often preferred because of fears about hot spots.
  - MACT Maximum Achievable Control Technology

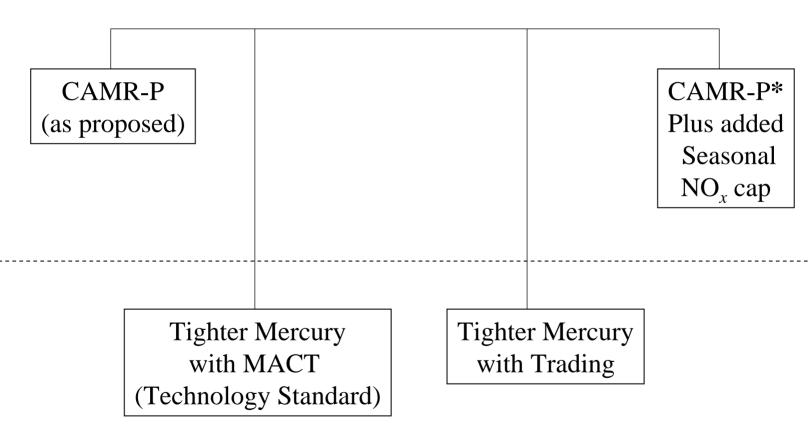


### **Outline**

- Overview of Policies Analyzed
- Emissions Impact of Policies
- Compliance Strategies of Firms
- Effects on Consumers and Producers
- Net Benefits
  - Without mercury-related benefits
  - Including mercury-related benefits
- Conclusions



### CAIR-P (as proposed)



\* This scenario is most similar to EPA's final rules.



### Proposed CAIR Rule (CAIR-P)

• Caps emissions of  $SO_2$  and  $NO_x$  in 28 eastern states in 2 phases.

Emission Allowance Allocations in Millions of Tons

	$2010 (09 \text{ for NO}_x)$	2015
$\mathrm{SO}_2$	3.86	2.7
$NO_x$	1.6	1.33

- Pre-existing bank means 2015 SO2 cap not reached for many years.
- Seasonal  $NO_x$  SIP trading program is eliminated.

#### Final CAIR Rule (CAIR-F)

- Includes seasonal NO<sub>x</sub> trading program in east.
- Covers slightly different set of states and different states covered for annual and seasonal programs.
- Uses different method to allocate  $NO_x$  allowances that more closely matches historic emissions.

CAIR by itself would reduce mercury emissions in the CAIR region.



# **Selected Hg Emission Modification Factors from US EPA**

Con	figuration of Cont	trols	% Hg	Removal
$\overline{SO_2}$	Particulate	$NO_x$	Bit Coal	Sub Bit Coal
None	BH/FF		89	73
Wet	BH/FF	SCR	90	85
Dry	BH/FF		95	25
None	CSE		36	3
Wet	CSE	SCR	90	66
None	HSE/Oth		10	6
Dry	HSE/Oth		40	15
Wet	HSE/Oth	SCR	90	25

Mercury content of bituminous coal is typically higher than that of subbituminous coal.



### Proposed CAMR Rule (CAMR-P)

- Caps national emissions of mercury from electricity generators.
- Safety valve on mercury allowance price of \$35,000 per lb.
- Allows trading and banking of allowances

#### Final CAMR Rule (CAMR-F)

- Greater mercury allocations (38 tons) in first phase and no allowance price cap (safety valve). The combined effect produces an emissions trajectory over time similar to proposed rule.
- As a result of banking, Phase 2 mercury cap not achieved until several years after 2018.

Mercury Emissions Allowance Allocations in Tons

	2010	2018
CAMR-P	34	15
CAMR-F	38	15

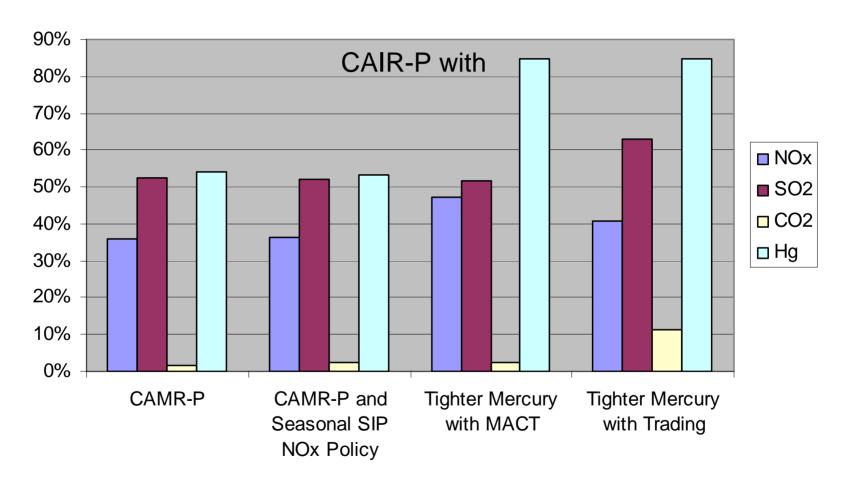


### **Tighter Mercury Regulations Scenarios**

- MACT: Impose 90% reduction in emissions or emission rate standard of 0.6 lbs per trillion Btu, whichever is less expensive, on all generators.
- Trading: Take national mercury emissions level resulting from above exercise for each year and use cap and trade approach to achieve that level.



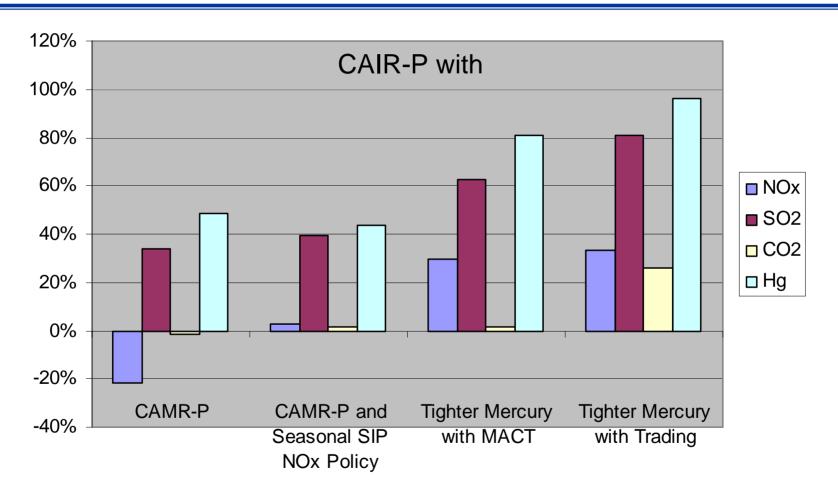
## National Emission Reductions in 2020



All policies deliver substantial reductions in emissions of targeted pollutants.



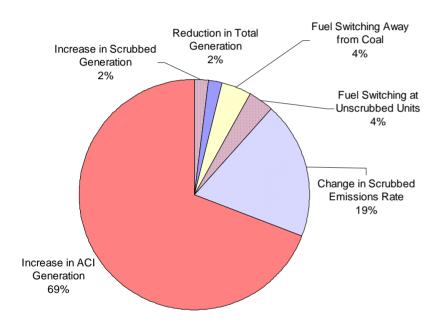
### Emission Reductions in New York in 2020



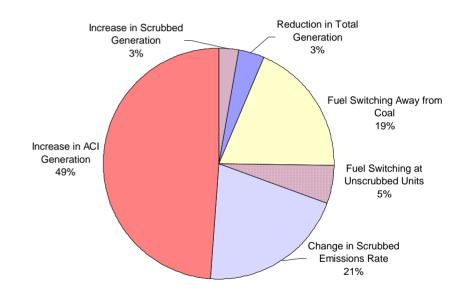
There is greater variation in emissions impacts in New York across policy options.

# How Hg Reductions are Achieved under CAIR-P plus Tighter Mercury Restrictions

#### **MACT**

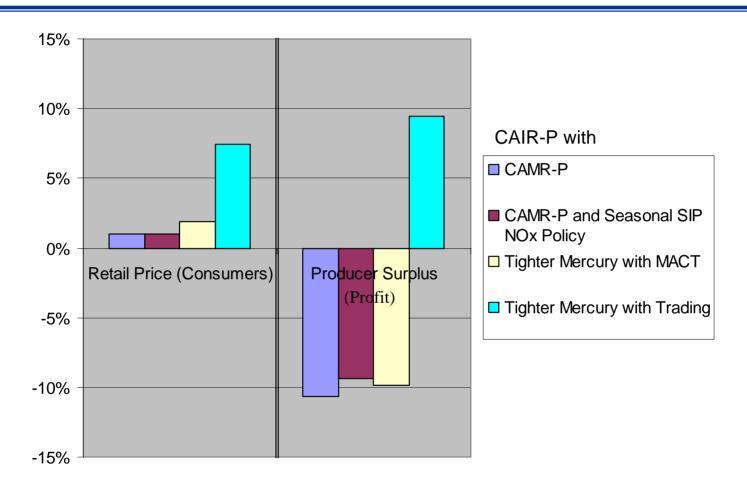


### **Trading**





### **National Price and Profit Effects in 2020**

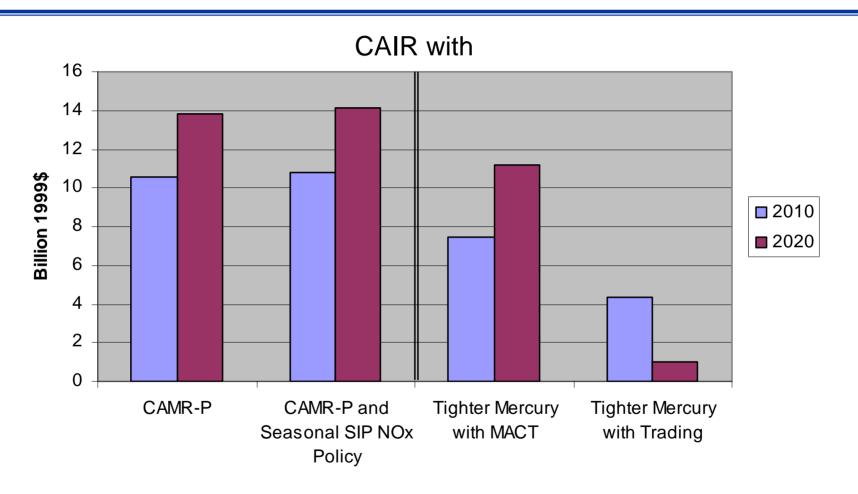


Impact of policies on electricity price is small except with Tighter Mercury with Trading. In that case, electricity price rise is large and producer profits rise.



### **National Net Benefits by Policy**

(Benefits minus Costs)



All policies produce positive net benefits in New York and Nationwide.



### **Mercury Benefits**

- Net benefits on previous slide do not include mercury related benefits.
- Rice and Hammit (2005) estimate the benefits of mercury caps in the Clear Skies Act.
- We extrapolate from their work to infer mercury related benefits of the policies we analyze.
- We consider a range of estimates capturing uncertainties related to mercury and to other inputs to the overall benefits calculation.



### Mercury Related Benefits of Clear Skies Act (Rice and Hammit)

Value of Statistical Life	26 ton mercury cap	15 ton mercury cap
\$5.8 million (1999\$)	\$2.8 billion	\$4.0 billion
\$2.2 million (1999\$)	\$1.1 billion	\$1.6 billion

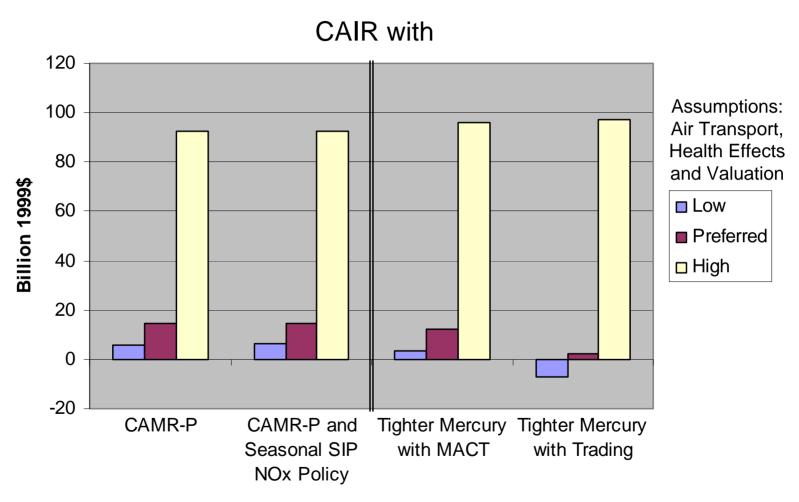


### **Extrapolated Mercury Benefits**

	IQ Deficits	Cardiovascular effects	Total
Benefits per Ton of Hg Reduced	\$4M - \$10M	\$1M - \$63M	\$5M - \$73M
	Total Annual Benefits – 2010		
EPA Mercury	\$96M - \$239M	\$24M - \$1.5B	\$120M - \$1.7B
Tighter Mercury	\$176M - \$439M	\$44M - \$2.7B	\$220M - \$3.1B
•	Total Annual Benefits – 2020		
EPA Mercury	\$97M - \$242M	\$24M - \$1.5B	\$121M - \$1.7B
Tighter Mercury	\$184M - \$459M	\$46M - \$2.9B	\$230M - \$3.3B



### The Effect of Uncertainties on Net Benefits



Net benefits are positive over a wide range of uncertainties.



### **Bottom Line**

The reductions in emissions that would be achieved under the EPA final rules or any of the policy alternatives we investigate offer important economic benefits in excess of costs to the Empire State and to the nation as a whole.



### **Conclusions on Mercury**

- Mercury-related benefits of CAMR are largely in the future due to co-benefits of CAIR.
- How mercury emissions are regulated has important implications for emissions of SO<sub>2</sub>, NO<sub>x</sub> and CO<sub>2</sub> and where those emissions are located.
- Largely as a result of induced fuel switching, mercury trading leads to greater reductions in mercury emissions in New York State than does MACT approach under the strict mercury targets.
- MACT is a way to preserve a role for coal if stricter mercury targets were to win the day.

