

The Costs and Benefits of Reducing Emissions from the Electricity Sector

Karen Palmer

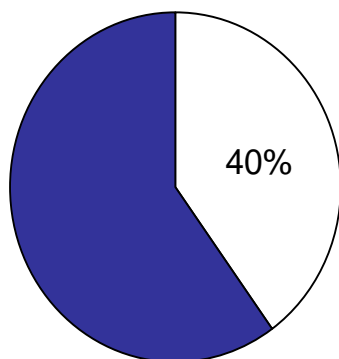
EIA Economics Working Group

May 11, 2005

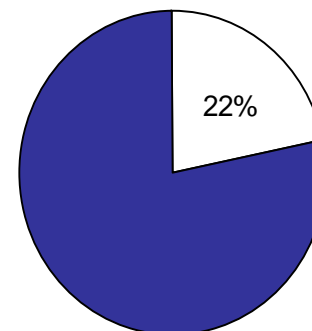


Electricity's Contribution to Annual Emissions

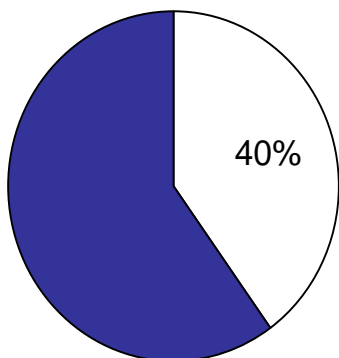
Carbon Dioxide (CO₂)



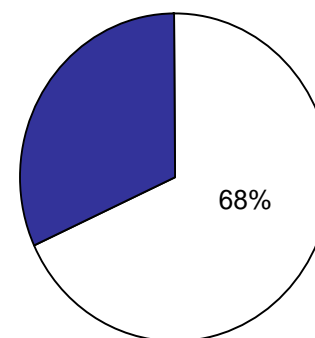
Nitrogen Oxides (NO_x)



Mercury (Hg)



Sulfur Dioxide (SO₂)



Multipollutant Policy History and Acronyms

- Federal legislation is stalled.
- At least 8 states, including New York, have multipollutant policies.
- EPA recently finalized two new rules:
 - Clean Air Interstate Rule (CAIR)
 - Clean Air Mercury Rule (CAMR)
- Many state officials are eager to see tougher restrictions on mercury emissions and technology based approach is often preferred due to fears about hot spots.
 - MACT – Maximum Achievable Control Technology

Four Policy Cases Analyzed

CAIR-P (as proposed)

Moderate Mercury Caps

CAMR-P
(as proposed)

CAMR-P*
plus
Seasonal SIP
NO_x cap

Strict Mercury Caps

Tighter Mercury
with MACT
(Technology Standard)

Tighter Mercury
with Trading

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

CAIR-P (as proposed)

- Caps annual allocation of emission allowances for SO₂ and NO_x from EGUs in 28 states, mostly east of Mississippi.
- Caps are imposed in two phases: 2010 and 2015.

Emission Allowance Allocations in Millions of Tons

	2010	2015
SO ₂	3.86	2.7
NO _x	1.6	1.33

- Regulation includes potential for trading and banking of emission allowances.
- Seasonal NO_x SIP trading program is eliminated.

CAMR-P (as proposed)

- Caps national annual allocation of emission allowances for mercury from all EGUs.
- Emissions allowances limited to 34 tons in 2010 and 15 tons in 2018.
- Safety valve on mercury allowance price is set at \$35,000 per pound of mercury.
- Regulation includes potential for trading and banking of emission allowances..

Final CAIR Rule (CAIR-F)

- CAIR-F includes seasonal NO_x trading program in east.
- CAIR-F covers slightly different set of states; and different states covered for annual and seasonal programs.
- CAIR-F uses different method to allocate NO_x allowances that more closely matches historic emissions.

	2010	2015
SO₂	3.7	2.6
	2009	2015
NO_x	1.5	1.3

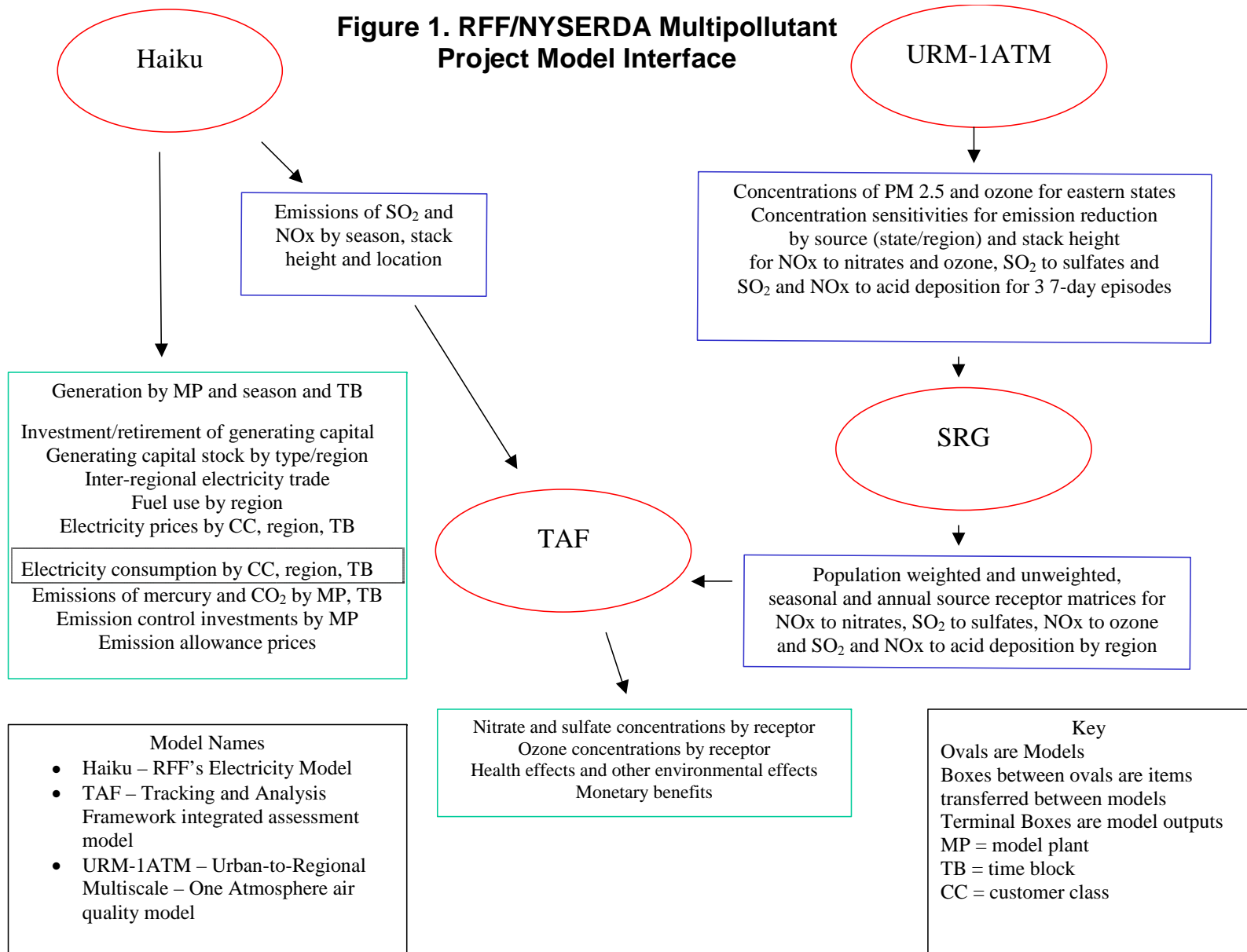
Final CAMR Rule (CAMR-F)

- 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.

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.

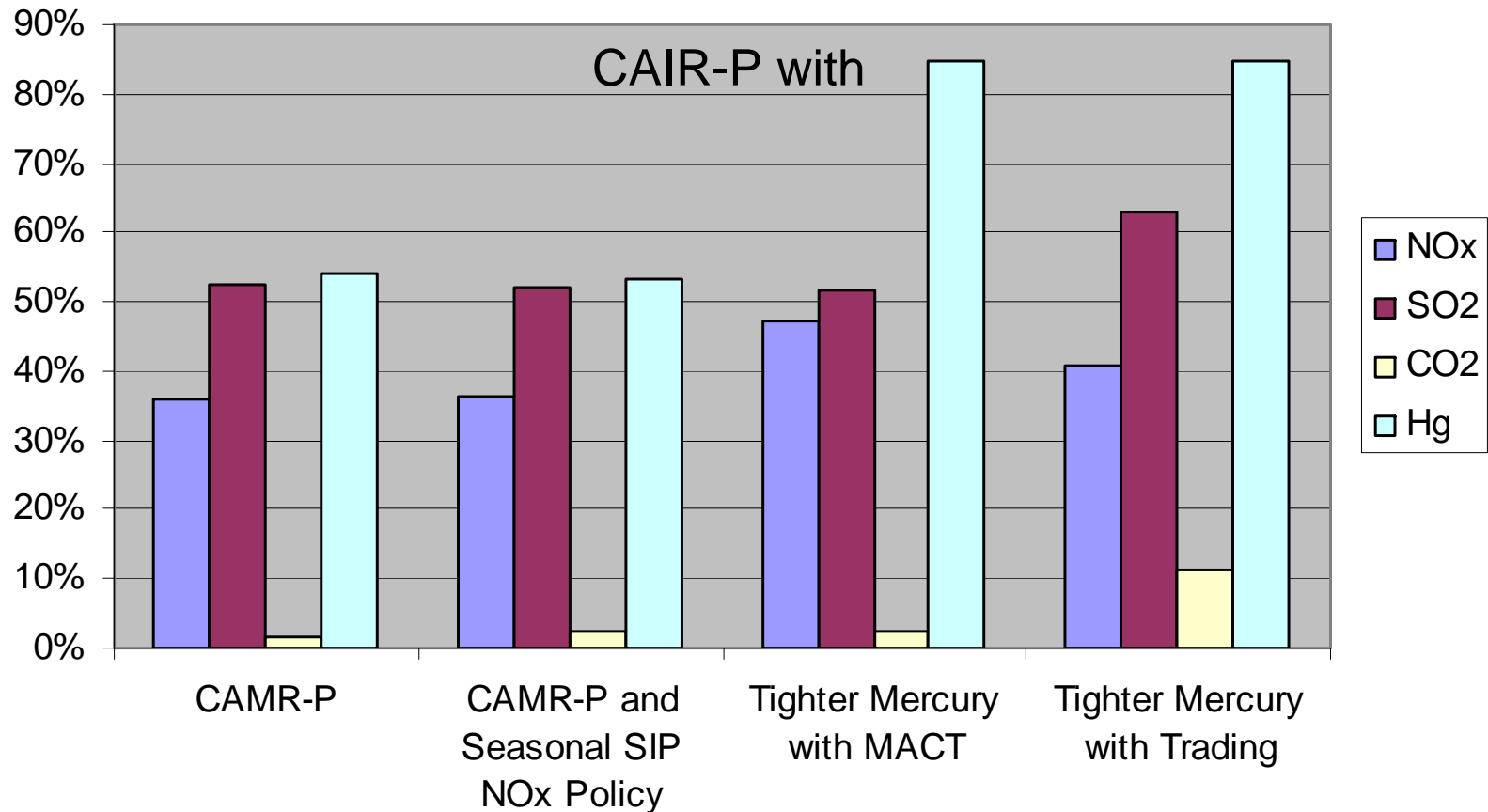
Figure 1. RFF/NYSERDA Multipollutant Project Model Interface



Maintained Assumptions

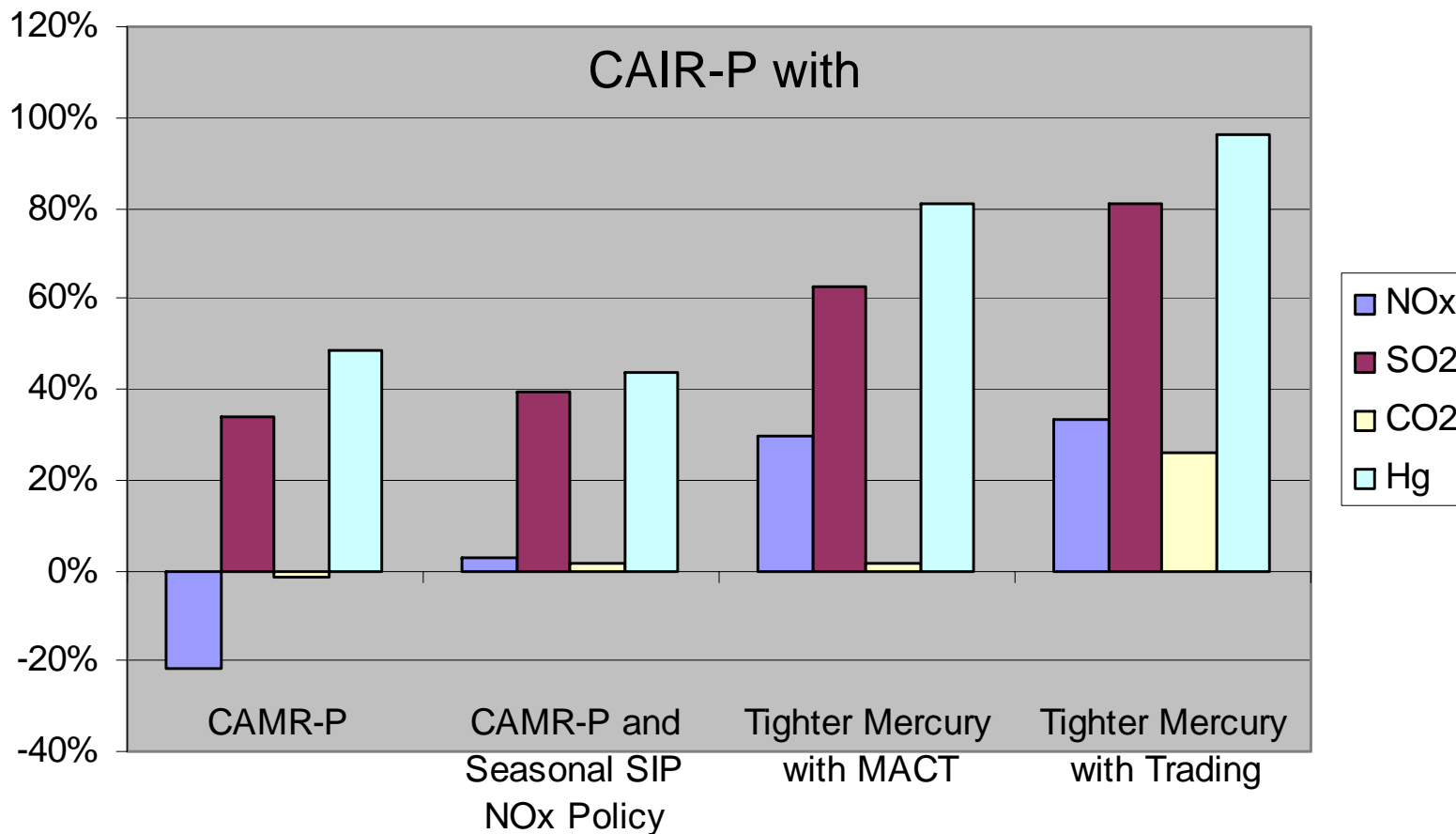
- Only steam fossil plants install retrofit controls.
- No emissions cap on CO₂.
- *Limited restructuring*: Five regions (NY, NE, MAAC, ERCOT, ECAR) with competitive prices and time of day pricing for industrial customers.
- Announced NSR settlements are included as are several state-level multi-pollutant rules. Only partial representation of state-level RPS policies.
- All prices in 1999 real dollars.

National Emission Reductions in 2020



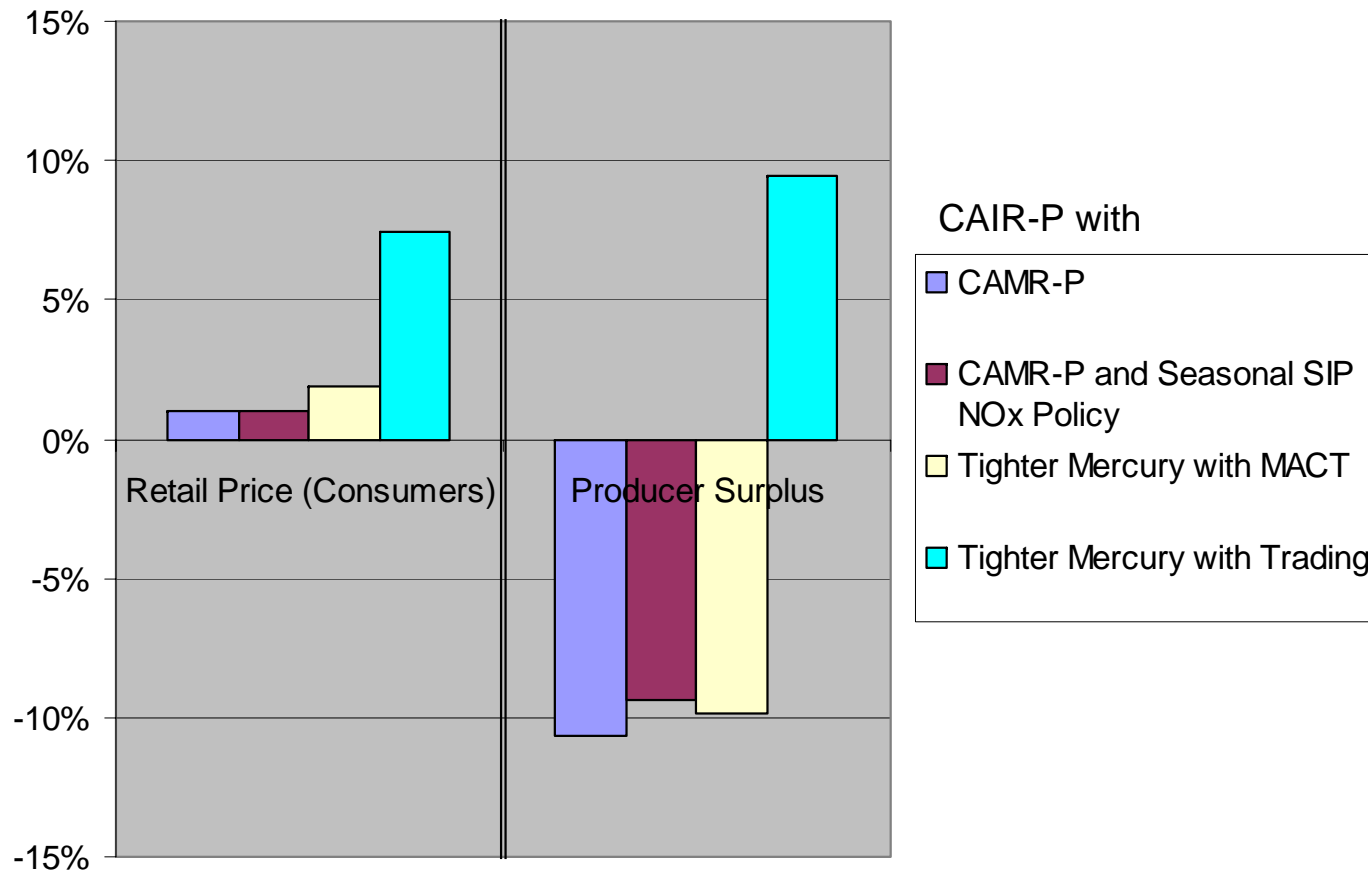
All policies deliver substantial reductions in emissions of targeted pollutants.

Emission Reductions in New York in 2020



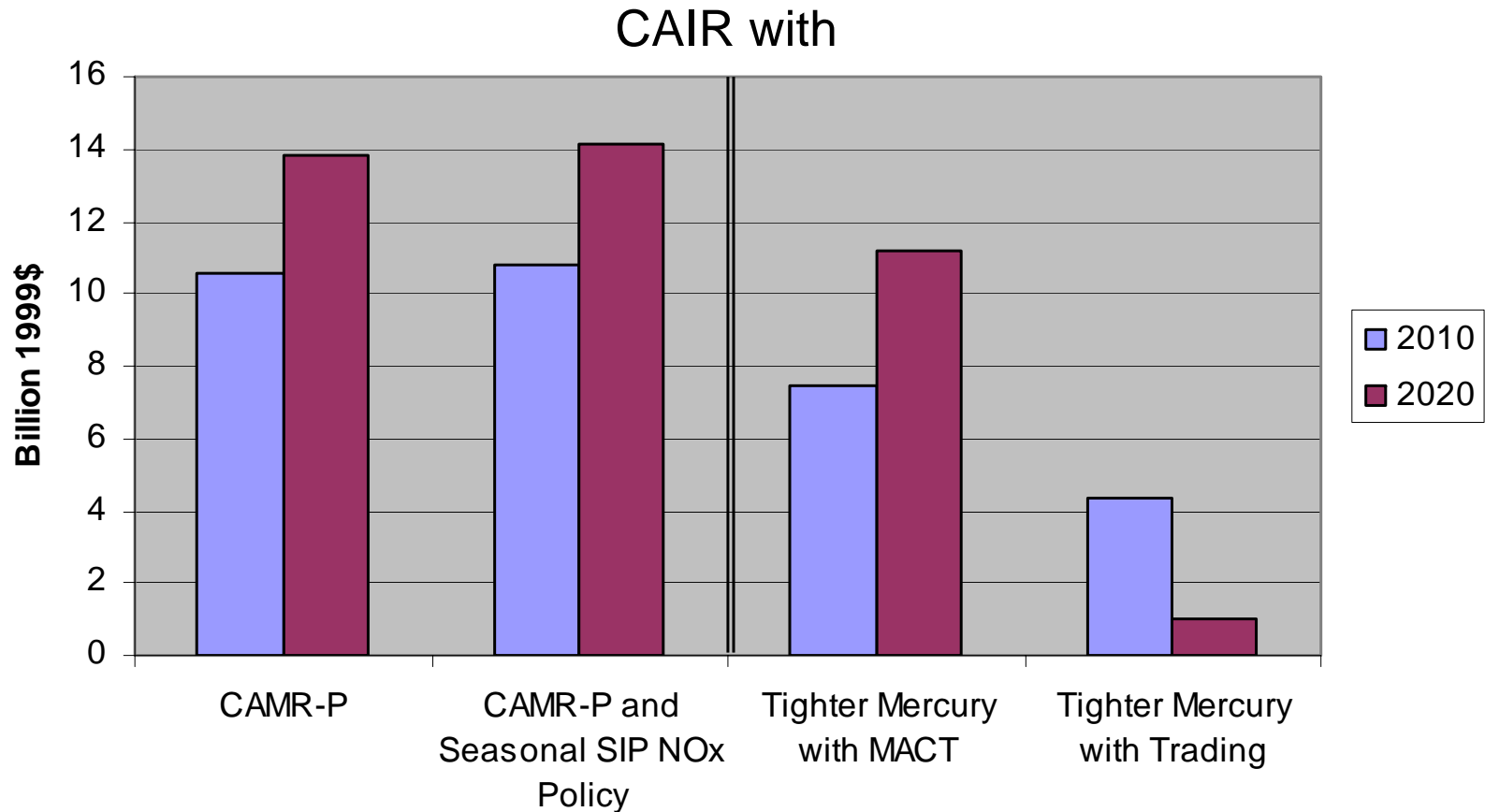
There is greater variation in emissions impacts in New York across policy options.

Price and Profit Effects



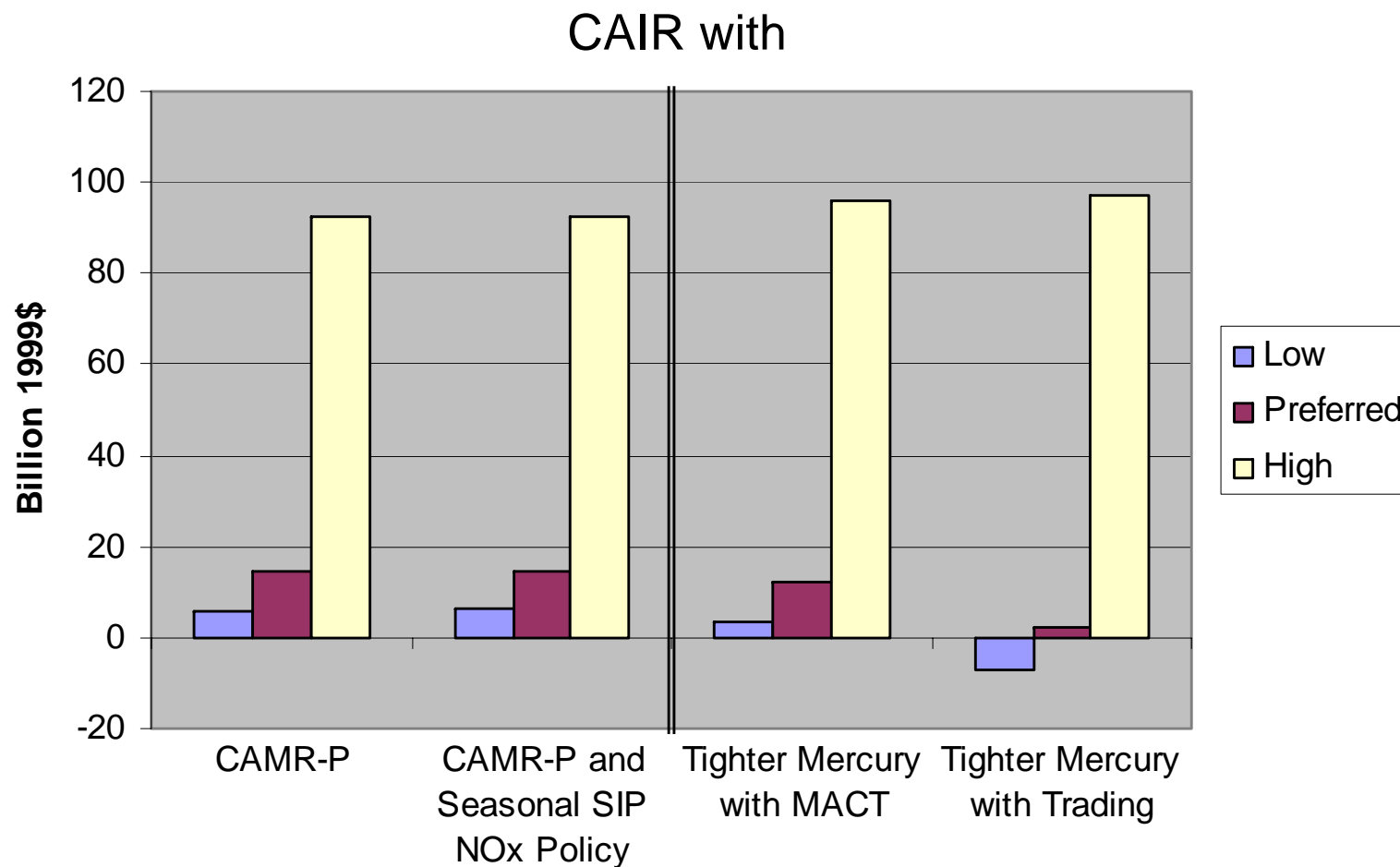
Impact of policies on electricity price is small except with Tighter Mercury with Trading. In that case, electricity price rise is large and producer profits rise.

National Net Benefits by Policy



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

The Effect of Uncertainties on Net Benefits



Net benefits are positive over a wide range of uncertainties.

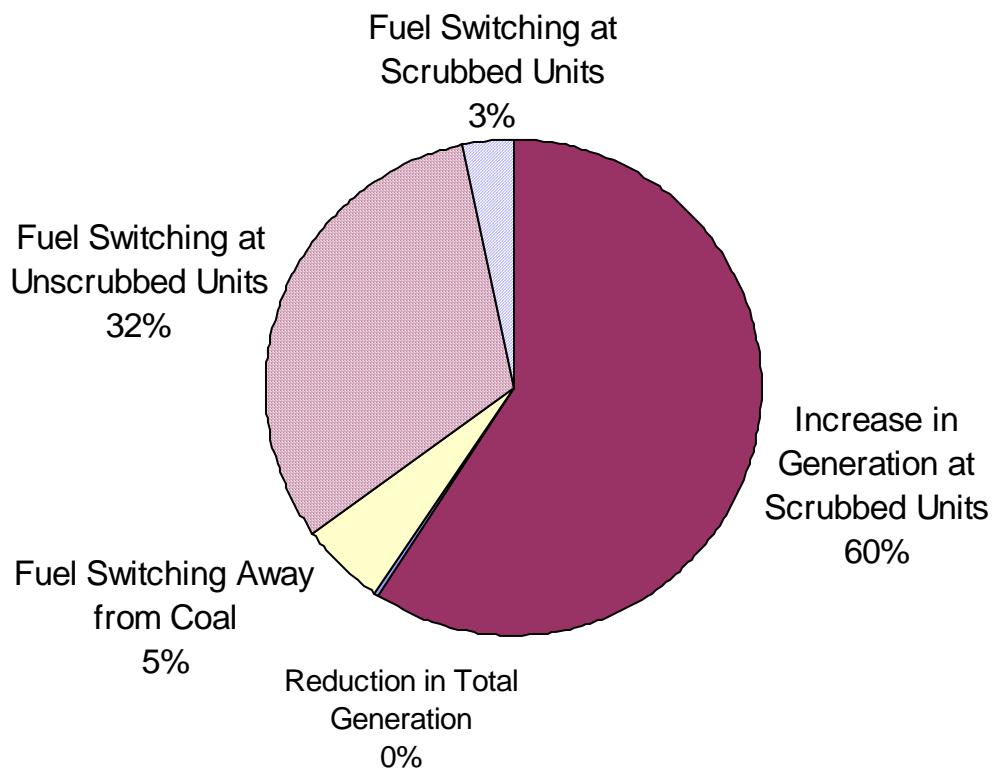
Benefits and Costs Included in Net Benefits Analysis

Benefits		
	Main Analysis	Uncertainty Analysis
Ozone Morbidity	Yes	Yes
Ozone Mortality	Yes	Yes
Particulate Morbidity	Yes	Yes
Particulate Mortality	Yes	Yes
Visibility	No	No
Acid Deposition	No	Partial
Mercury Morbidity	No	Yes
Mercury Mortality	No	Yes
Mercury Ecological	No	No
Costs		
Electricity Sector	Yes	Yes
Economywide	No	No

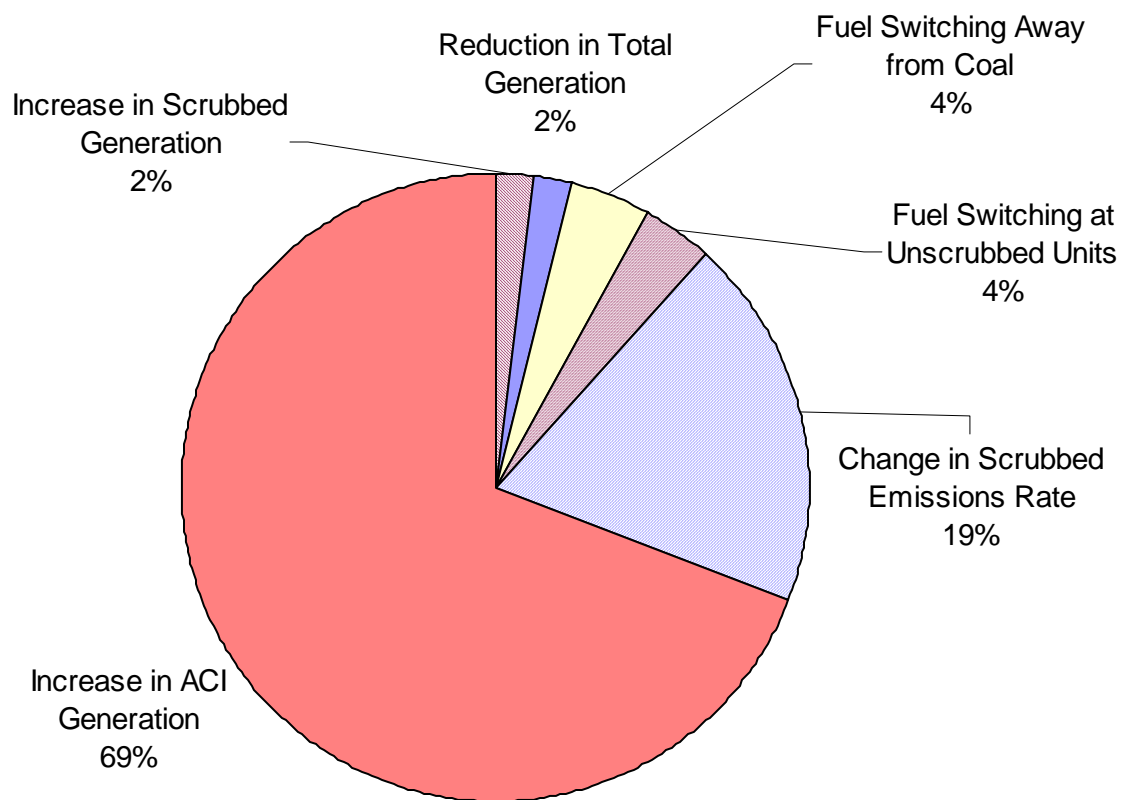
Evaluation of CAIR-F (final)

- EPA decision to maintain seasonal NO_x policy in its final CAIR rule improves the net benefits relative to CAIR-P and helps the Northeast.
- However, EPA does not maximize net benefits with CAIR-F because SO₂ caps could be tighter and provide even higher net benefits.

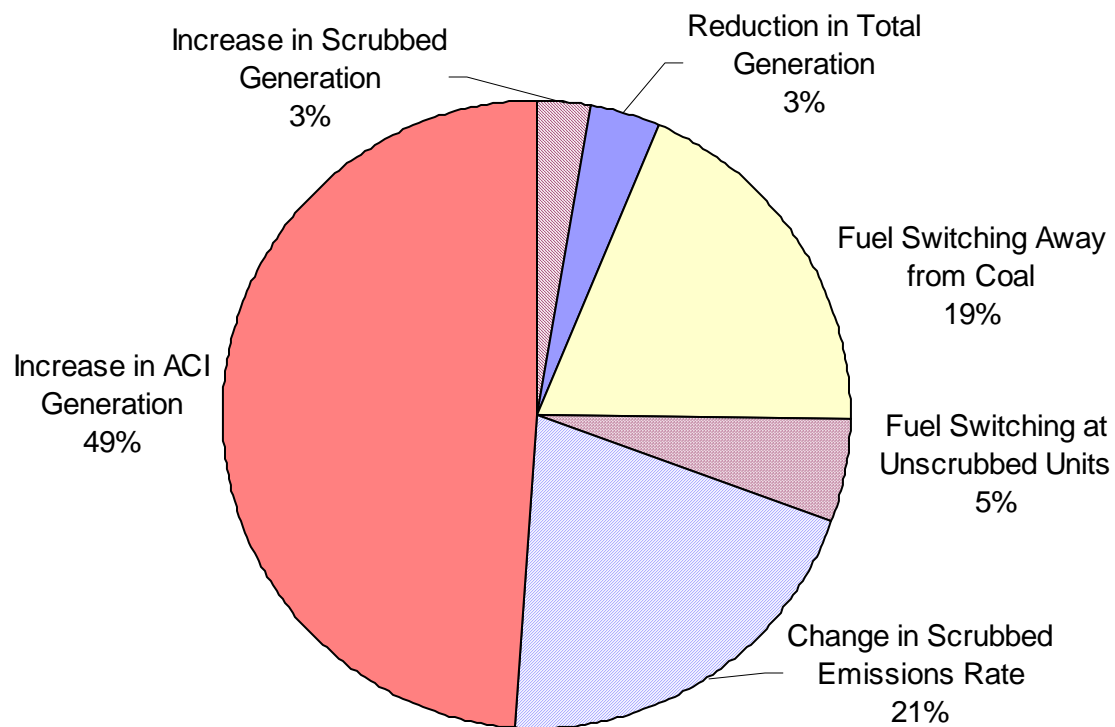
How SO₂ Reductions are Achieved under CAIR-P with CAMR-P



How Hg Reductions are Achieved under CAIR-P plus Tighter Mercury with MACT

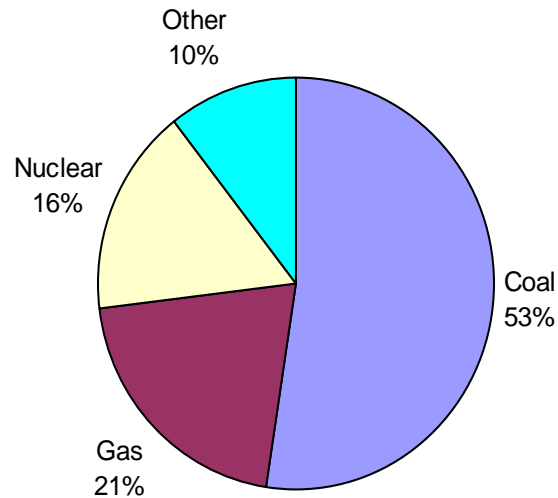


How Hg Reductions are Achieved under CAIR-P plus Tighter Mercury with Trading

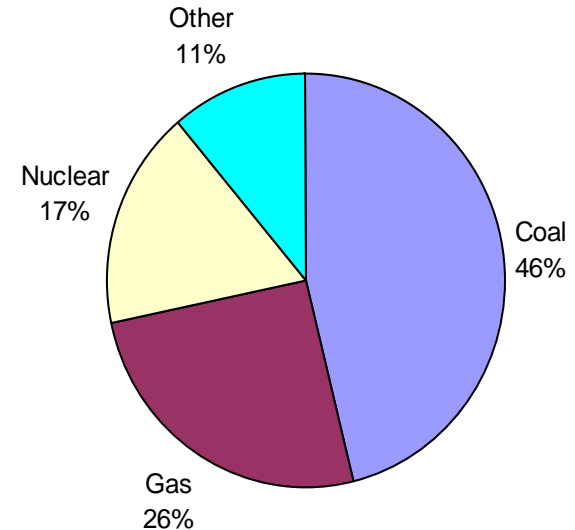


National Fuel Shares under CAIR-P with Tighter Mercury Caps in 2020

Tighter Mercury with MACT



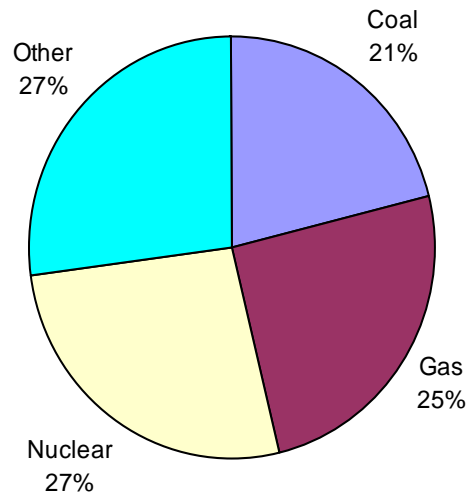
Tighter Mercury with Trading



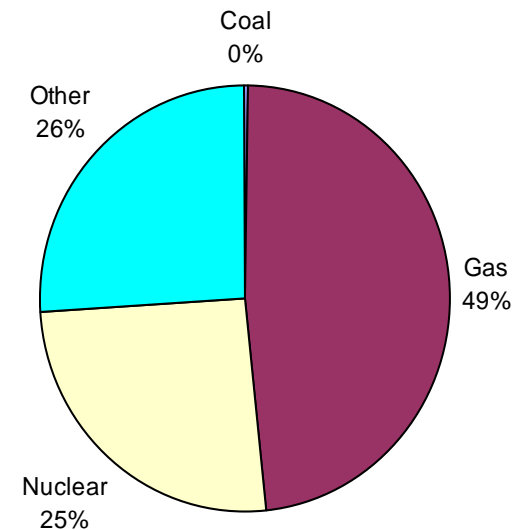
With strict mercury targets, administration goals of promoting market-based policy and fuel diversity collide.

New York Fuel Shares under CAIR-P Tighter Mercury Cap in 2020

Tighter Mercury with MACT



Tighter Mercury with Trading



With strict mercury targets and trading, coal-fired generation virtually disappears in New York by 2020.

Bottom Line

- The reductions in emissions that would be achieved under the EPA final rules or any of the alternatives we investigate offer important economic benefits in excess of costs.

Is CAIR/CAMR the Last Word?

- Economic analysis suggests that the benefits of even further reductions in SO₂ beyond CAIR requirements far exceed the costs.
- A constant stream of new discoveries about environmental and health effects of mercury are changing the terms of the policy debate on an ongoing basis.

**Look for this paper soon and more work
on multipollutant policies at
www.rff.org/multipollutant.**