



Emissions Control for Power Generation

**USGS SPARROW WORKSHOP
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Power Generation Emissions Reductions

Currently--

- Title IV (Acid Rain Program) passed by Congress as part of the 1990 Clean Air Act Amendments and began to take effect in 1995.
- NOx SIP Call will take effect in the 2004 ozone season.

Proposed--

- On February 14, 2002, President Bush proposed the Clear Skies Initiative, a mandatory program for the control of sulfur dioxide (SO₂), nitrogen oxides (NOx) and mercury (Hg) from the electricity generation sector.
- On July 26, 2002, Chairman Billy Tauzin and Chairman Joe Barton introduced the Clear Skies Act in the U.S. House of Representatives (H.R.5266), and on July 29, 2002 Senator Bob Smith introduced the legislation in the Senate (S.2815) by request of the Administration.
- Extensive information on Clear Skies is currently available on EPA's website at www.epa.gov/clearskies.

Caps and Timing for the Electric Power Sector under the Clear Skies Act

2004: The NO_x SIP call (summertime NO_x cap in 19 Eastern States + D.C.)

2004

2008: Clear Skies NO_x Phase I (2.1 million ton annual cap assigned to two Zones with trading programs)

2008

2010: Clear Skies Hg Phase I (26 ton annual cap with a national trading program)

2010: SO₂ Phase I (4.5 million ton annual cap with a national trading program)

2012

2018: Clear Skies NO_x Phase II (1.7 million ton annual cap assigned to two Zones with trading programs)

2016

2018: Clear Skies Hg Phase II (15 ton annual cap with a national trading program)

2018: Clear Skies SO₂ Phase II (3.0 million ton annual cap with a national trading program)

2020

Human Health Benefits

- Clear Skies would reduce fine particle concentrations in the East and Midwest by 10-20%
- The monetized health benefits of the Clear Skies Act would total approximately \$93 billion annually by 2020 due to reductions in PM_{2.5} and ozone alone
 - 11,900 fewer premature deaths
 - 7,400 fewer cases of chronic bronchitis
 - 11,900 fewer hospitalizations/emergency room visits for cardiovascular and respiratory symptoms
 - 15 million fewer days with respiratory illnesses and symptoms, including work loss days, restricted activity days, and days with asthma attacks
- An alternative estimate projects annual health benefits of \$11 billion due to 7,200 fewer premature deaths
- Many additional, unquantified health benefits, including the benefits of reduced exposure to mercury, would also occur under Clear Skies

Environmental Benefits

- Improve visibility in the East and Midwest by 1-2 deciviews
- \$3 billion in benefits from improving visibility at select National Parks and Wilderness Areas annually by 2020
- \$56 million in benefits from reducing agricultural damage from ozone annually by 2020
- **Many additional, unquantified benefits would also occur under Clear Skies, resulting from:**
 - 30% less sulfur deposition over much of the sensitive eastern U.S.
 - 15-30% less nitrogen deposition over much of the sensitive eastern U.S., including coastal areas
 - Up to 25% less mercury deposition over much of the eastern U.S.
 - Virtually elimination of chronic acidity in Northeastern lakes and prevention of further deterioration of acidic Southeastern streams

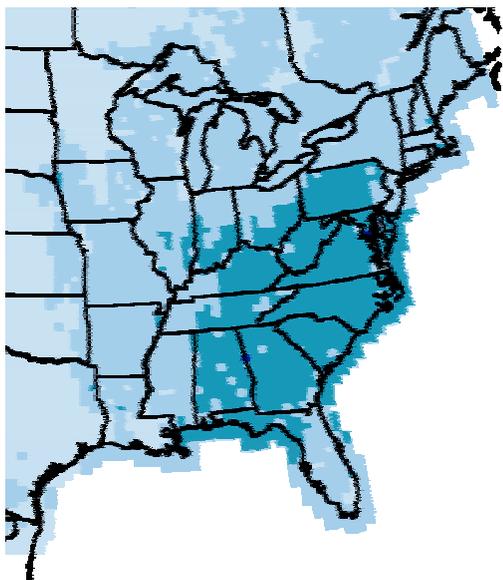
NAAQS Attainment Benefits

By 2020, based on initial modeling, Clear Skies is expected to:

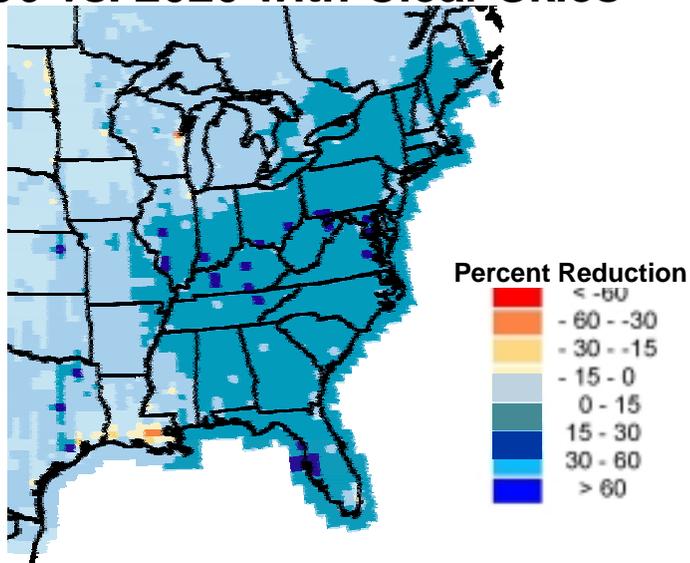
- bring 54 additional counties, home to approximately 21 million people, into attainment with the new fine particle standard as compared to existing programs (Base Case). The remaining non-attainment counties are expected to move closer to attainment
- bring 8 additional counties, home to 4 million people, into attainment with the new ozone standard as compared to existing programs. The remaining non-attainment counties are expected to move closer to attainment

Sulfur Deposition (2020)

2020 Base Case vs. Clear Skies



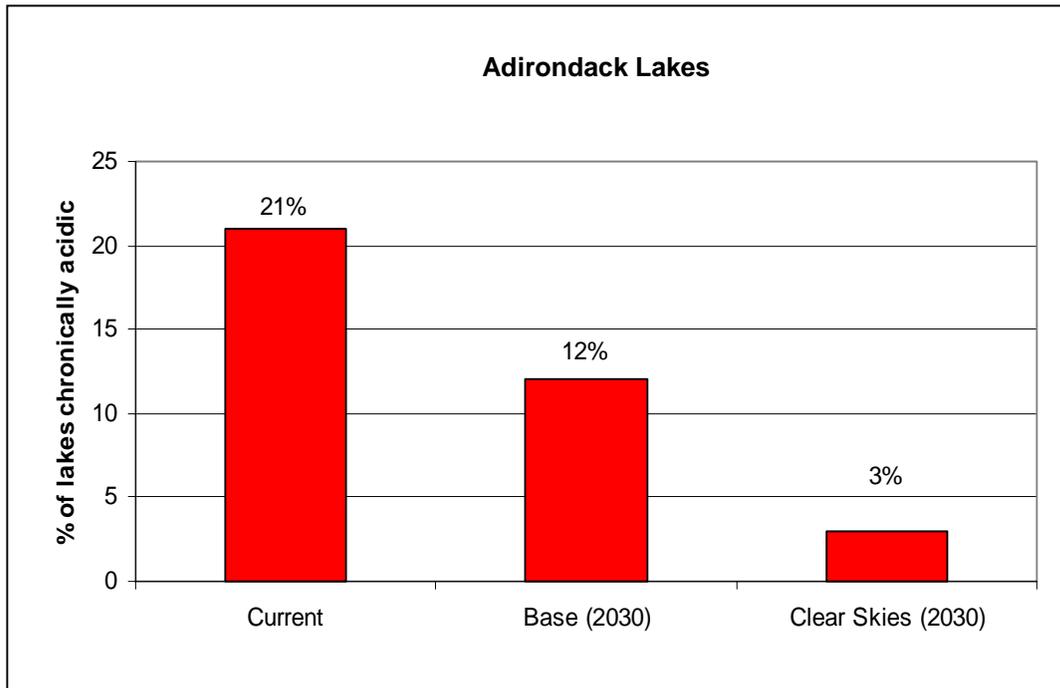
1996 vs. 2020 with Clear Skies



- The upper map demonstrates that Clear Skies would achieve significant additional reductions of sulfur deposition of up to 60% beyond what is expected under the Base Case in 2020.
- The lower map demonstrates that Clear Skies in combination with existing programs would contribute to significant reductions in sulfur deposition from current levels across much of the East.

Reduced Acidity of Lakes and Streams

- Under the Base Case, lake conditions improve but 12% of lakes would remain chronically acidic in 2030.
- With Clear Skies, lake conditions would improve dramatically by 2030: only 3% of lakes would remain chronically acidic.*



- However, a significant proportion of Adirondack lakes would still become acidic periodically due to seasonal or storm events.

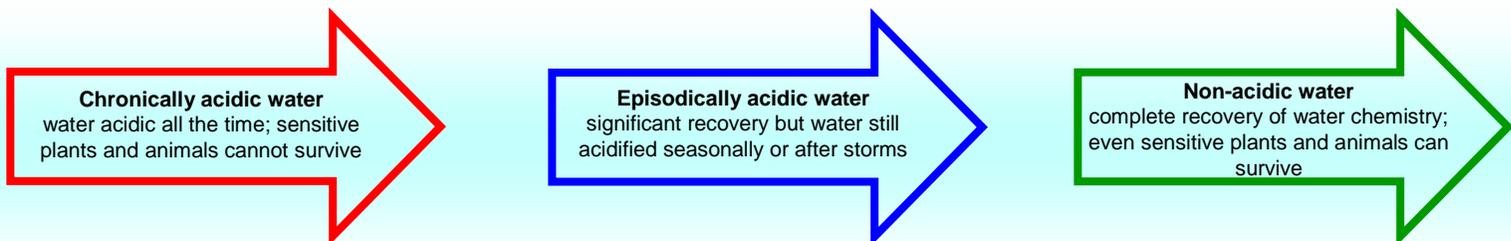
Note: This may be an overestimate of recovery under existing programs due to the fact that this modeling focuses only on sulfur deposition.

- In addition to reducing the number of chronically acidic lakes in the Northeast and Adirondacks, Clear Skies would improve the acid buffering capacity of lakes in those regions.
- In the Southeast, Clear Skies would slow the deterioration of stream health expected under the Base Case.

		Current	Base Case (2030)	Clear Skies (2030)
	Northeastern Lakes			
	chronically acidic	10%	6%	2%
	episodically acidic	21%	25%	28%
	non-acidic	69%	69%	70%
	Adirondack Lakes			
	chronically acidic	21%	12%	3%
	episodically acidic	43%	52%	61%
	non-acidic	36%	36%	36%
	Southeastern Streams			
	chronically acidic	17%	17%	17%
	episodically acidic	19%	27%	25%
	non-acidic	64%	56%	58%

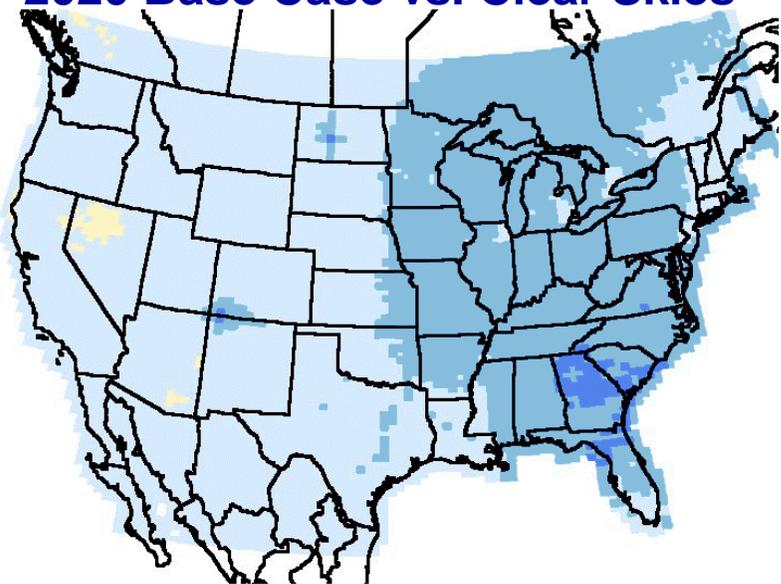
This table shows the percentage of waterbodies in regions of the Eastern U.S. that are chronically, episodically, and non-acidic under Clear Skies as compared to current conditions and the Base Case.

The Road to Recovery



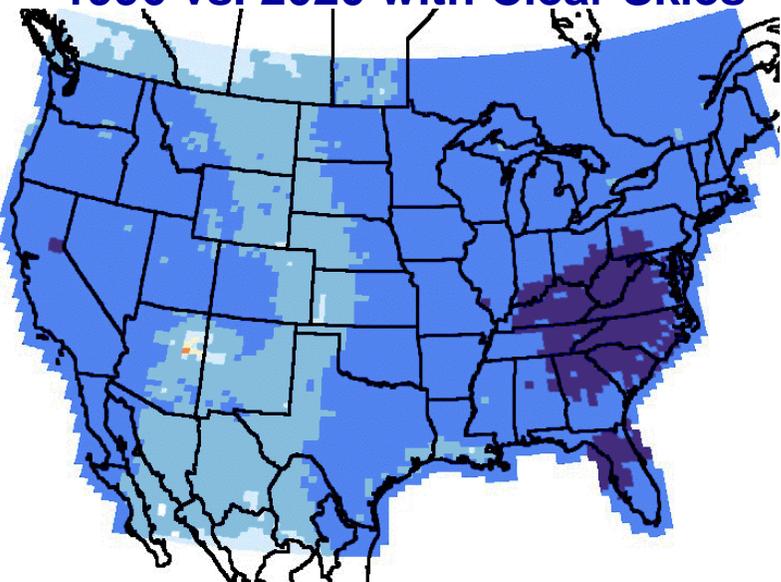
Percent Change in Nitrogen Deposition (2020)

2020 Base Case vs. Clear Skies



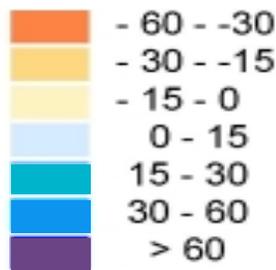
- The upper map demonstrates that Clear Skies would achieve significant additional reductions of nitrogen deposition of 15-30% across the eastern U.S. and in the Four Corners region beyond what is expected under the Base Case.

1996 vs. 2020 with Clear Skies



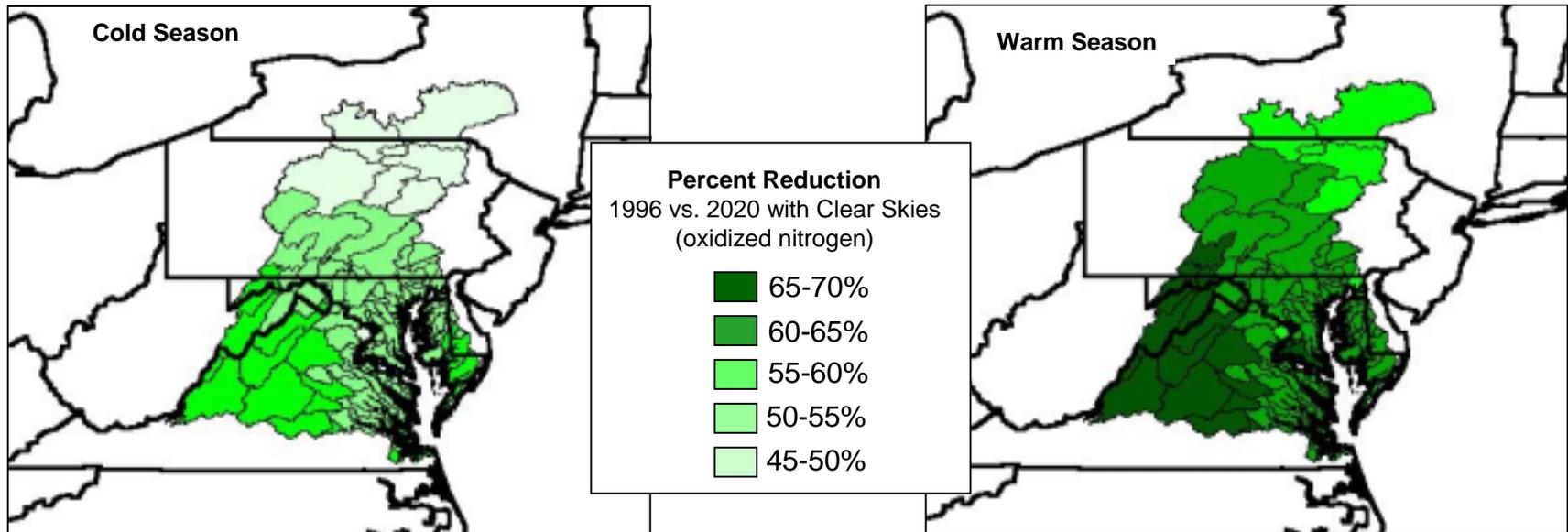
- The lower map demonstrates that Clear Skies **and** existing programs would reduce nitrogen deposition along most of the U.S. by up to 60% from current levels. A large portion of the Southeast would see reductions greater than 60%.

Percent Reduction



Nitrogen Deposition to the Chesapeake Bay Watershed (2020)

Percent Change 1996 vs. 2020 with Clear Skies



- Under the Clear Skies Act, in 2020, oxidized nitrogen deposition to the Chesapeake Bay watershed would be reduced by more than 50% from current levels.
- Reductions in oxidized nitrogen deposition would be greatest during the warm season, ranging from 50-70% across much of the watershed.

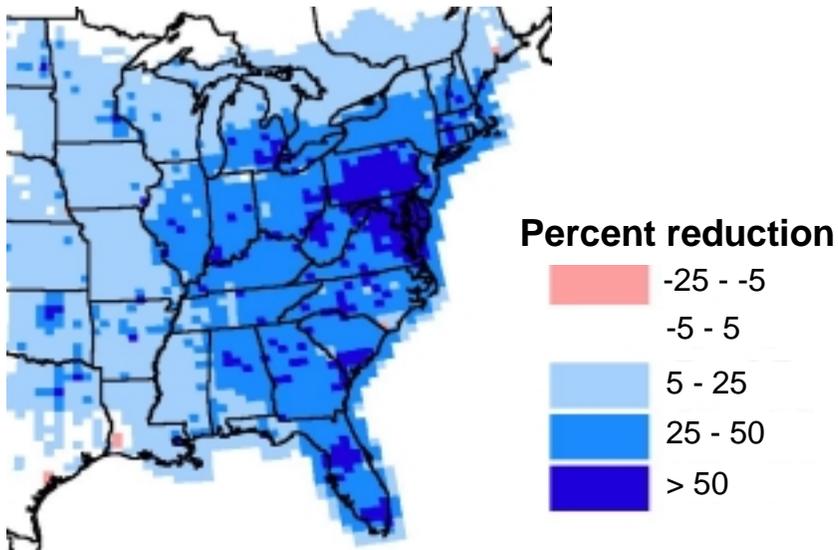
Percent Change in Mercury Deposition (2020)

2020 Base Case vs. Clear Skies



- The top map demonstrates that Clear Skies would achieve significant additional reductions of up to 25% across much of the East, including the eastern Gulf Coast, beyond what is expected under the Base Case.

1996 vs. 2020 with Clear Skies



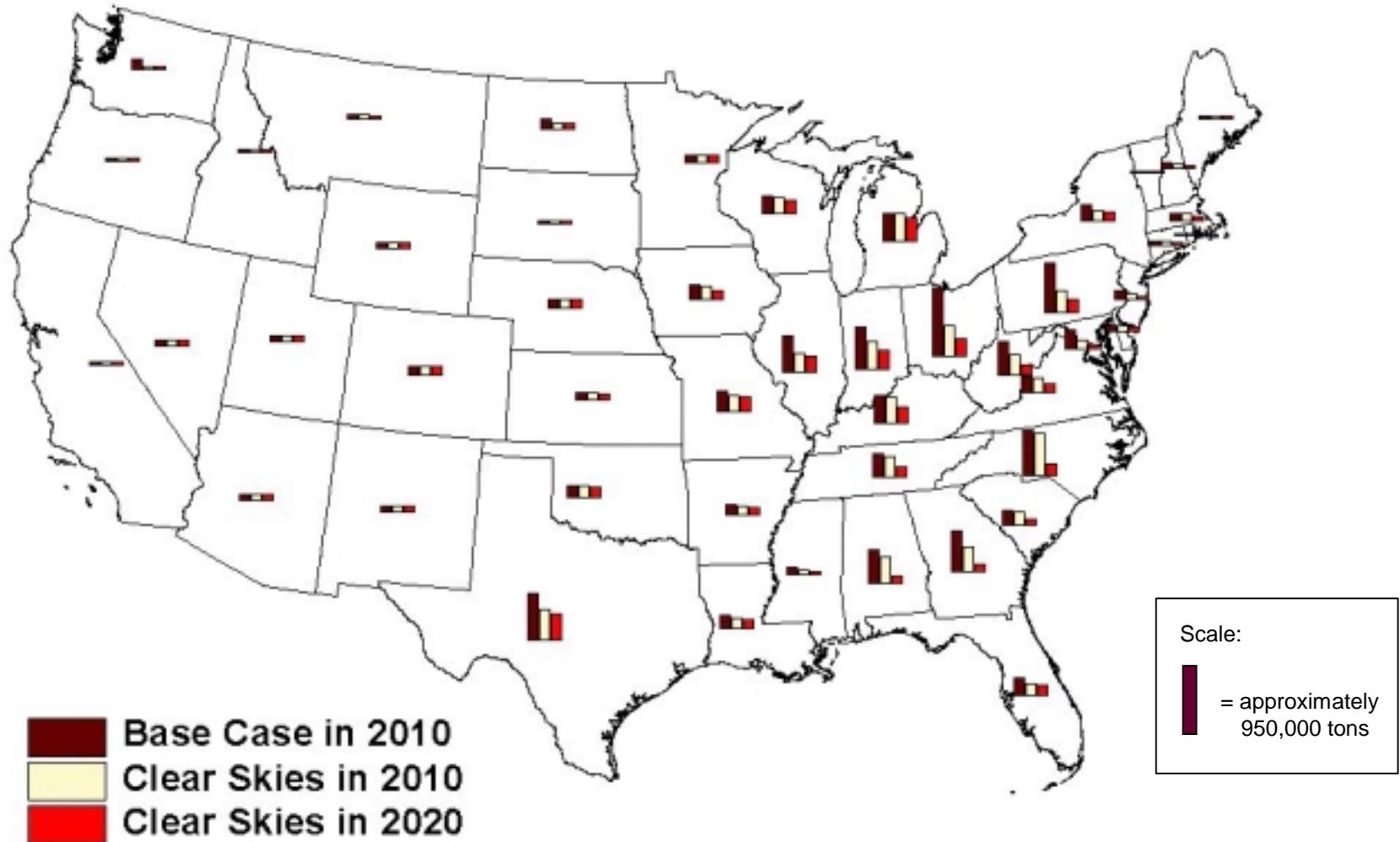
- The lower map demonstrates that Clear Skies **and** existing programs would reduce mercury deposition 50% or more in many areas of the eastern Gulf Coast states, and up to 25% along the western Gulf Coast.

A large school of fish, likely tuna, swimming in clear blue water. The fish are silvery and sleek, moving in various directions. The water is a deep, clear blue, and the lighting is bright, suggesting a sunny day. The fish are densely packed in some areas and more sparse in others, creating a sense of movement and activity.

Acid Rain Program: www.epa.gov/airmarkets

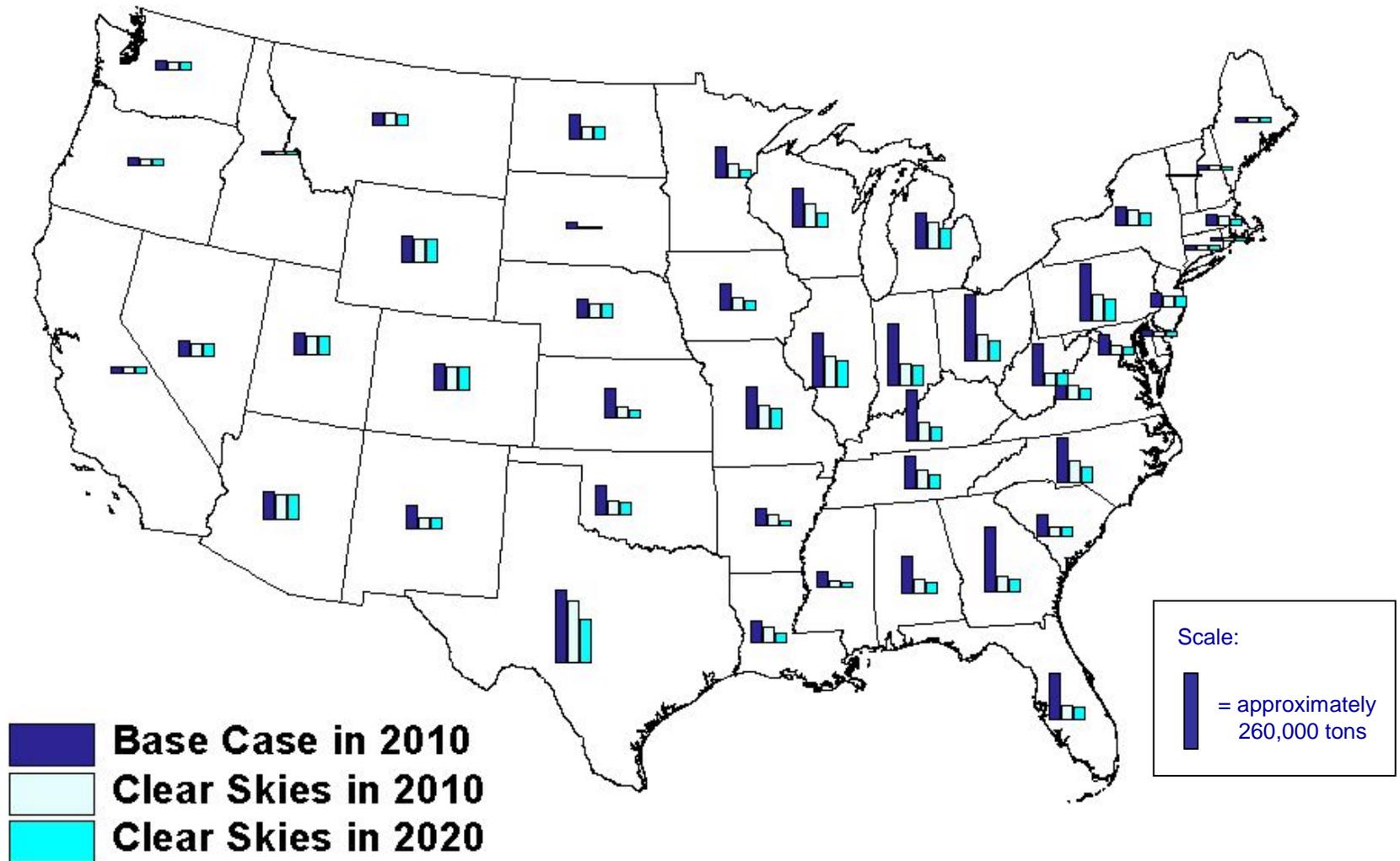
Clear Skies: www.epa.gov/clearskies

Emissions of Sulfur Dioxide



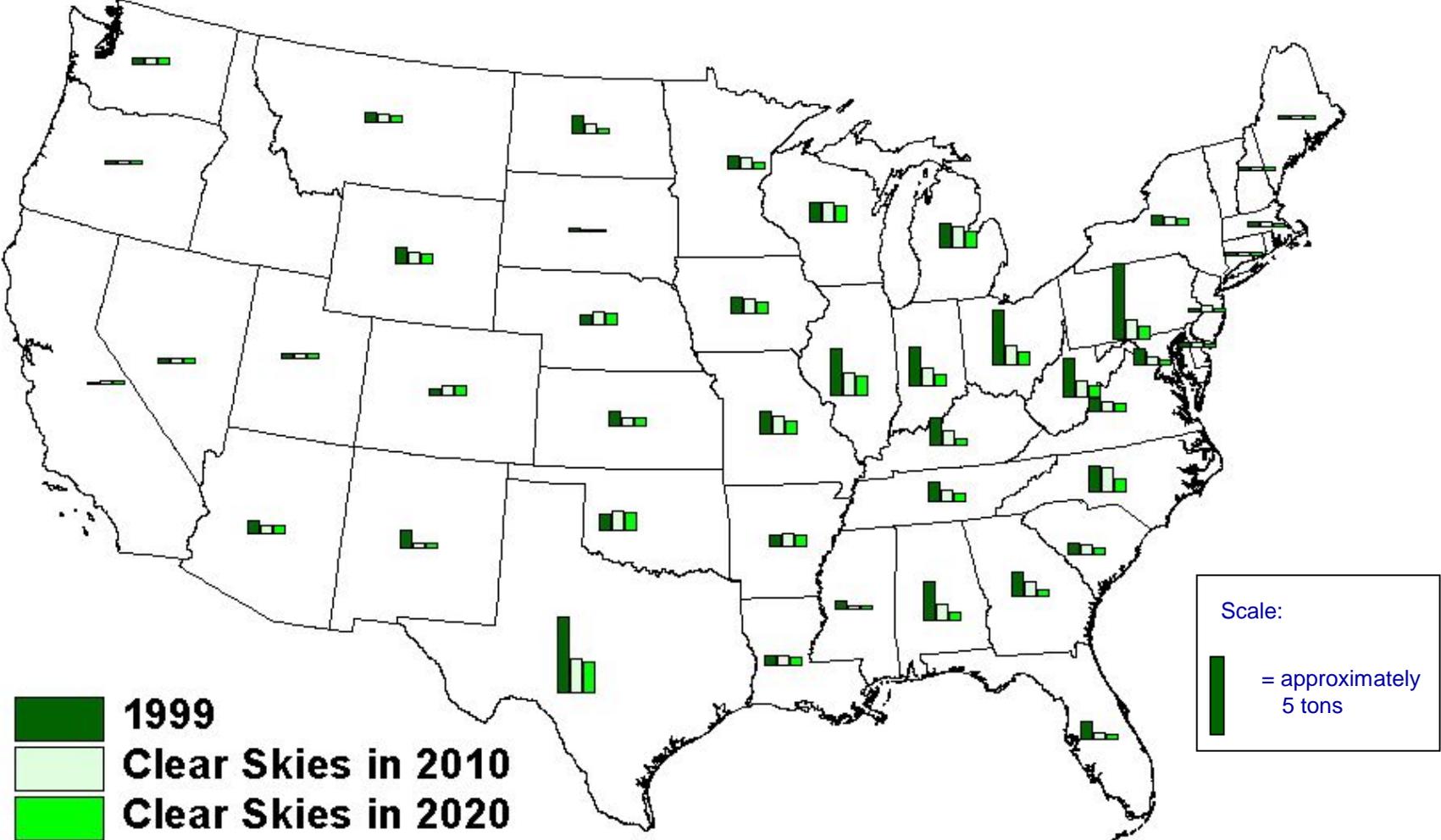
Note: Total emissions under the Base Case in 2010 would be 9.6 million tons; total emissions under Clear Skies in 2010 would be 6.6 million tons; total emissions under Clear Skies in 2020 would be 3.9 million tons. Emissions will continue to decline after 2020 until the cap level is reached. Emissions are from electric generating facilities greater than 25MW. The EPA 2000 Base Case in IPM includes Title IV, the NO_x SIP Call, and state-specific caps in Connecticut, Missouri and Texas. The Base Case does not include any potential future regulations to implement the current CAA.

Emissions of Nitrogen Oxides



Note: Total emissions under the Base Case in 2010 would be 4.2 million tons; total emissions under Clear Skies in 2010 would be 2.1 million tons; total emissions under Clear Skies in 2020 would be 1.7 million tons. Emissions are from electric generating facilities greater than 25MW. The EPA 2000 Base Case in IPM includes Title IV, the NO_x SIP Call, and state-specific caps in Connecticut, Missouri and Texas. The Base Case does not include any potential future regulations to implement the current CAA.

Emissions of Mercury



Note: Total emissions in 1999 were 48 tons; total emissions under Clear Skies in 2010 would be 26 tons; total emissions under Clear Skies in 2020 would be 18 tons. Emissions will continue to decline after 2020 until the cap level is reached. Emissions are from coal-fired electric generating facilities greater than 25MW.