

Regional Haze

AAPCA 2024 Spring Meeting
Indianapolis, IN

April 26, 2024

Regional Haze: West Virginia's Experience

West Virginia is member of Metro 4/ SESARM -
Southeastern Air Resource Managers

- Ten states – the eight states in Region 4 (AL, FL, GA, KY, MS, NC, SC, TN), VA and WV (Region 3), and 17 local members

VISTAS – Visibility Improvement State and Tribal Association of the Southeast

- Regional Haze SIP subgroup of SESARM
- One of five visibility Regional Planning Organizations

West Virginia - First Planning Period

AKA: Round 1, or the good ole days

Regional Haze: West Virginia

Round 1 – Focused on controlling major sources of visibility impairing air pollution

- VISTAS narrative template and modeling
- Primary drivers are SO₂ and NO_x from combustion sources
- Controlled most emissions via BART controls
- Straightforward to demonstrate “Reasonable Progress” with so many major point sources becoming controlled or shutting down
- EGU SO₂ reductions *significantly* contributed to progress at IMPROVE monitors
- Round 1 RH SIP *appeared* to be very successful...but was it successful on its own merits?

Regional Haze: West Virginia

West Virginia SO₂ & NO_x point source emissions dominated by large coal EGUs

- SO₂ and NO_x controls added to almost all West Virginia coal-fired EGUs

Almost 13,000 MWe WV coal EGU capacity now equipped with BART FGD SO₂ scrubbers

(17 units at 8 facilities)

Nearly 12,000 MWe WV coal EGU capacity now equipped with SCR NO_x controls

(15 units at 7 facilities; 2 units at 1 facility have SNCR)

Unit age ranges from 13 to nearly 59 years old

Average 49.5 years old

Only 4 WV coal units are subject NSPS 40CFR60, Subpart Da

Regional Haze Round 1

Federal Actions Parallel to Round 1

- Acid Rain Program
- Clean Air Interstate Rule (CAIR)
- Cross State Air Pollution Rule (CSAPR)
- Mercury Air Toxics Standard (MATS, 40CFR63 Subpart UUUUU)
- National major NSR suit settlements – required controlling, repowering, or retiring many older higher emitting coal EGUs

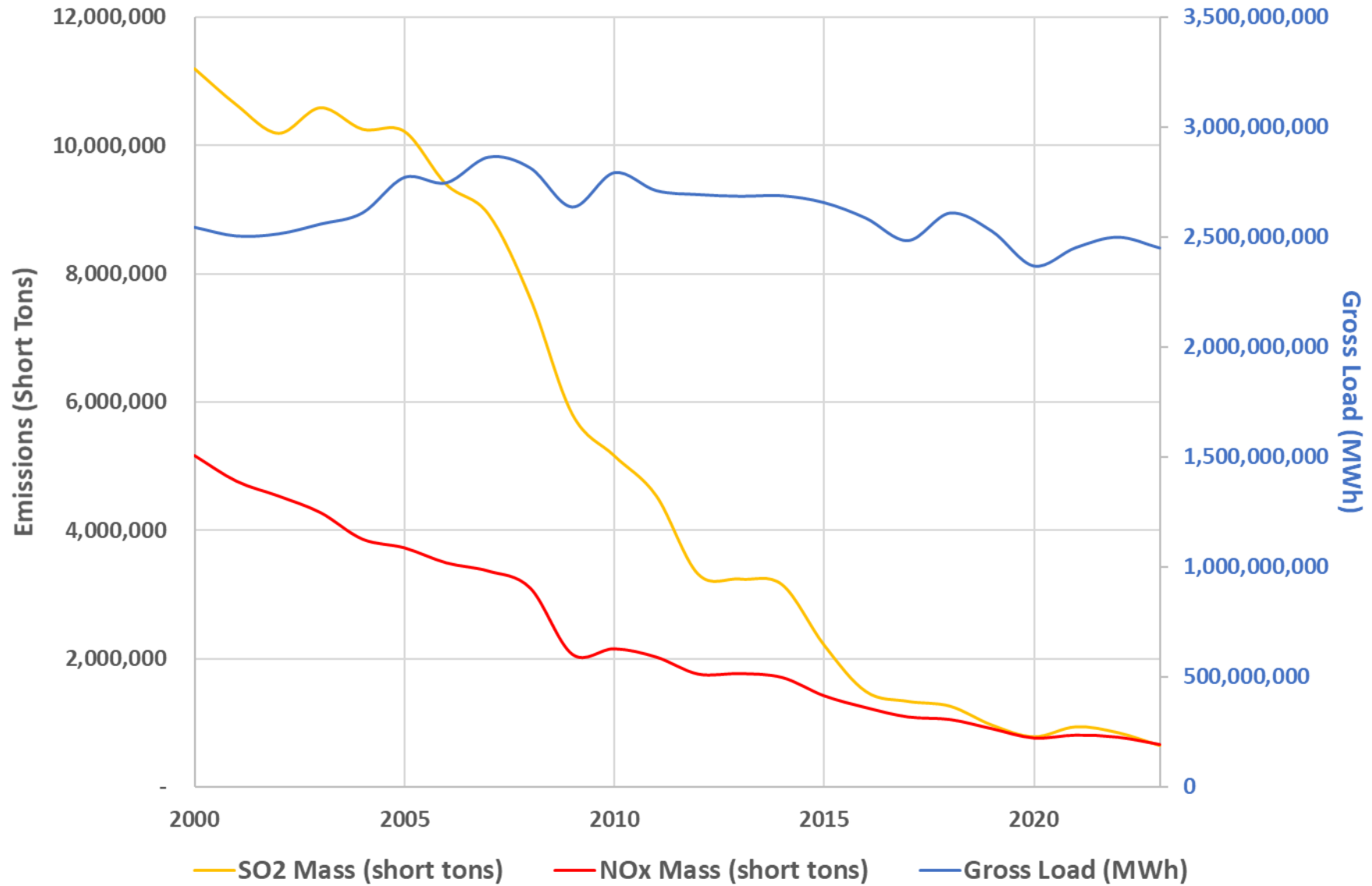
Regional Haze Round 1

Financial Reasons for SO₂ & NO_x Reductions

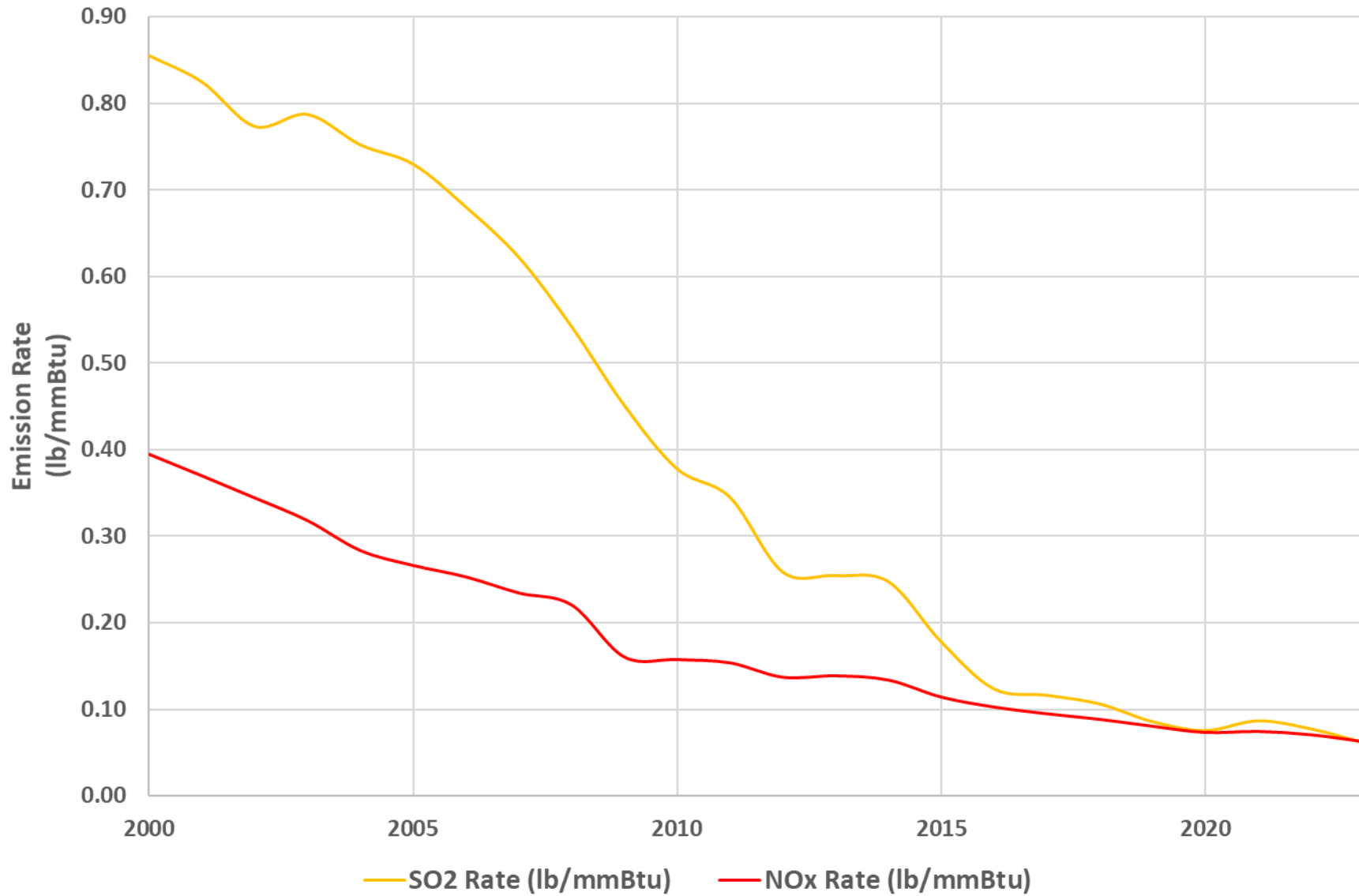
- **Low sulfur/high Btu coal became more expensive**
More economical to switch coal supply and add SO₂ controls
- **Uneconomical to repower boilers to natural gas, supply issues (pipelines, etc.)**
NG CT (esp. CCCT) have lower HR than boilers
NG CT are cheaper to build, maintain, and operate, esp. at select gas/power transmission crossroads
- **Older now-retired coal units had significantly higher heat rates**
Made sense to retire instead of controlling or repowering (NSR suits)
Nearly 3,000 MWe of old coal units retired in West Virginia in the mid-2010's (17 units at 6 facilities)
Retired units would today range from 63 to >80 years old, average age of nearly 71 years

It's all about economics.

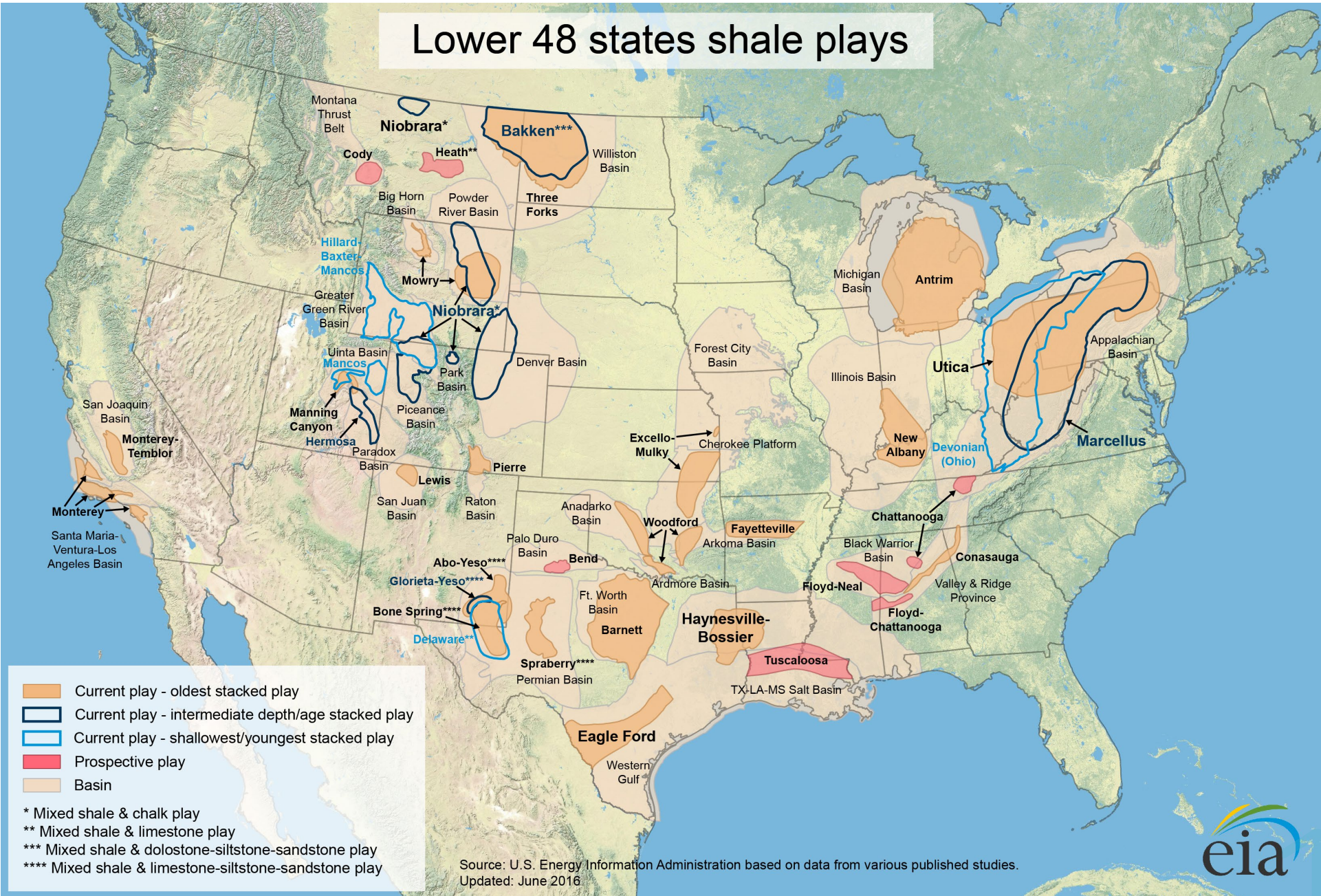
US Electricity Generation with SO₂ & NO_x Emissions 2000 - 2023



US EGU SO₂ & NO_x Average Emission Rates (lb/mmBtu) 2000 - 2023

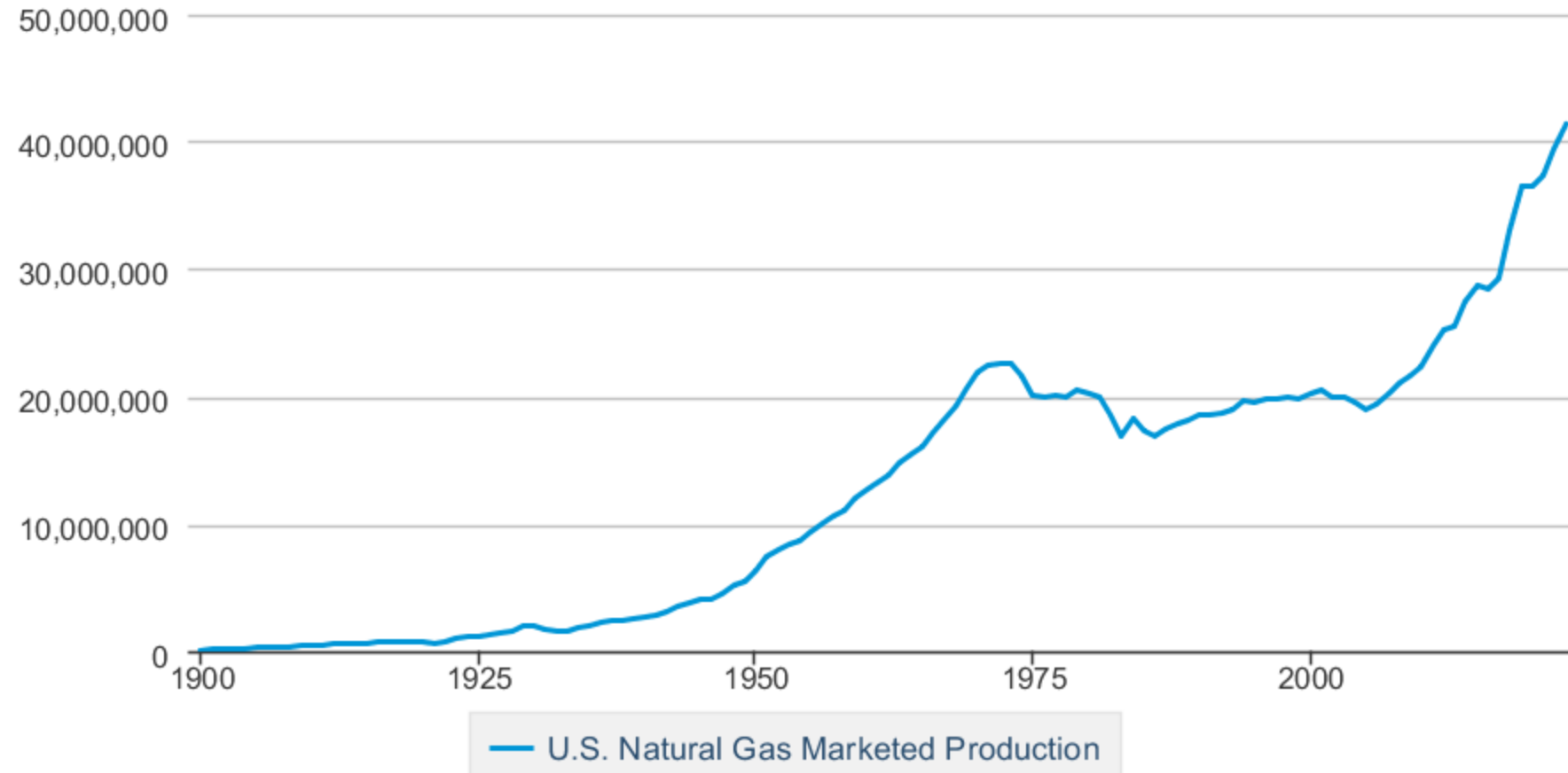


Lower 48 states shale plays



U.S. Natural Gas Marketed Production

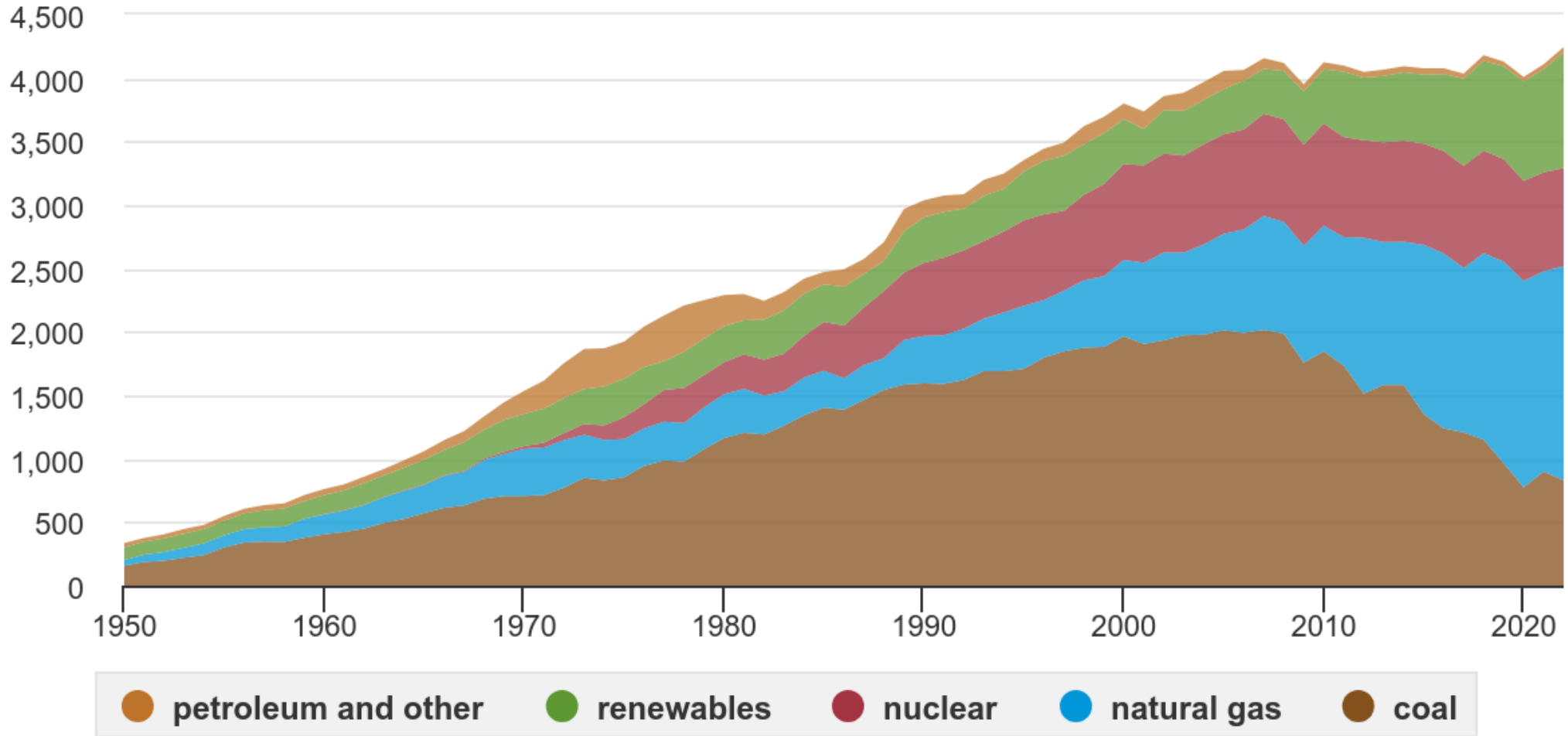
Million Cubic Feet



Data source: U.S. Energy Information Administration

U.S. electricity generation by major energy source, 1950-2022

billion kilowatthours



Data source: U.S. Energy Information Administration, *Monthly Energy Review* and *Electric Power Monthly*, February 2023, preliminary data for 2022

Note: Includes generation from power plants with at least 1 megawatt electric generation capacity.



EGU Dispatch Sequence

- **WV EGUs in PJM Regional Transmission Organization (RTO)**

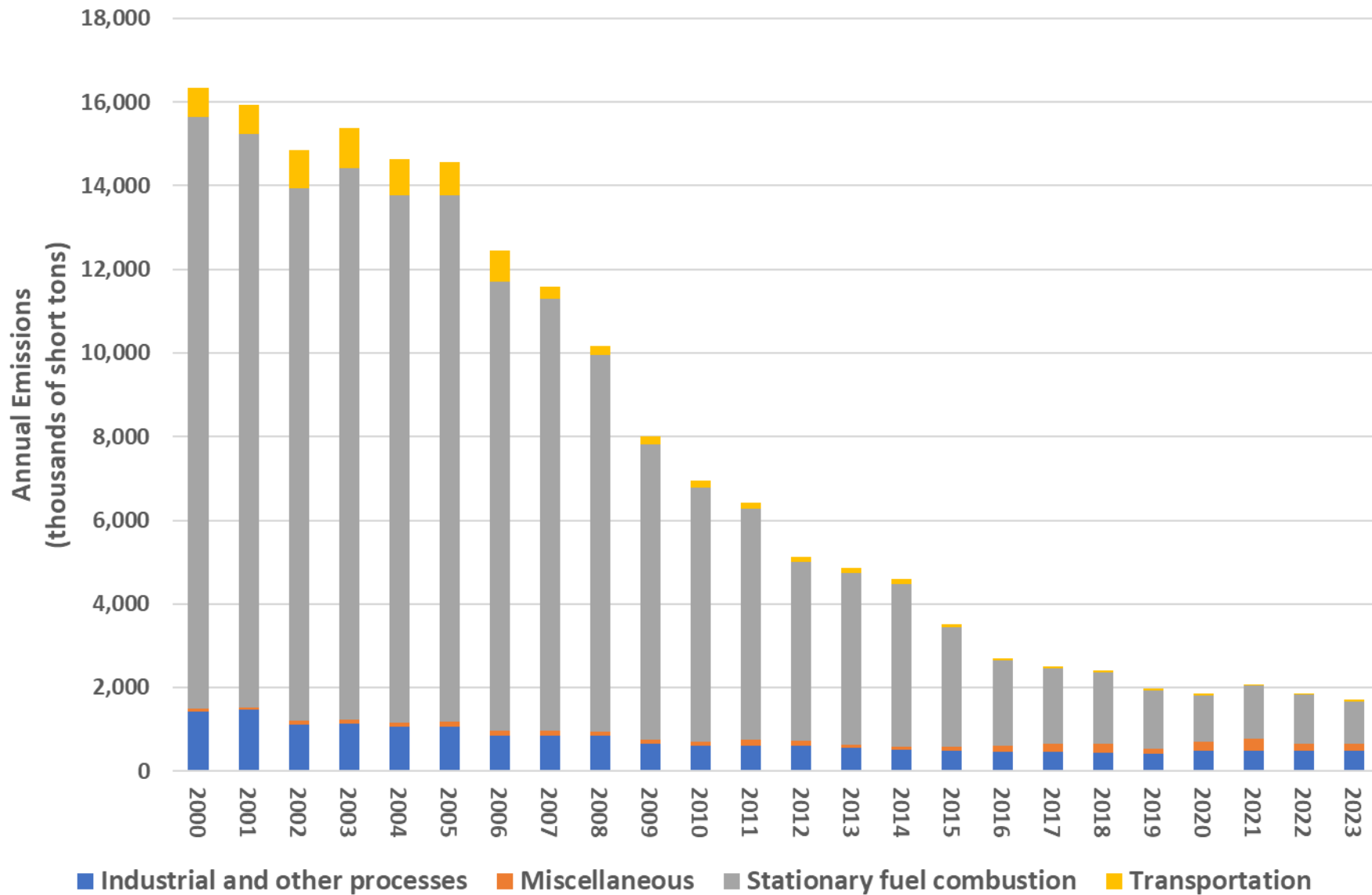
Generation assets dispatched based on bid-in for projected demand

Dispatch order – lowest bid to highest bid

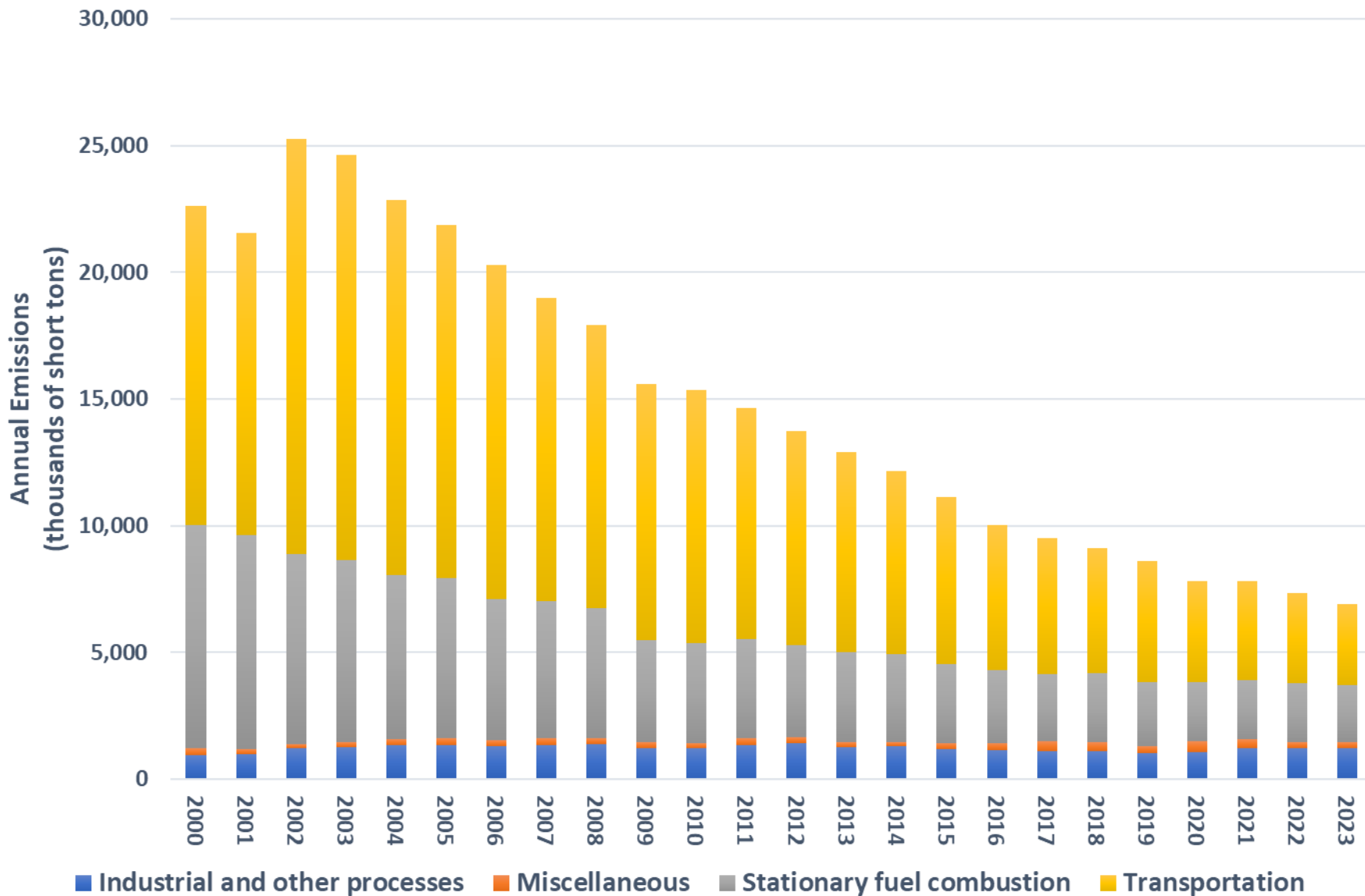
1. **Fission** – continuous baseload; capacity factors often >100%
2. **Renewables** – dispatched when available; hydro tends to be baseload; zero fuel cost is impossible to beat
3. **Natural Gas** – currently inexpensive; quickly dispatched; flexible & swing fast
4. **Coal** – traditional baseload; expensive; slow to dispatch; inflexible & swing slower

It's still all about economics.

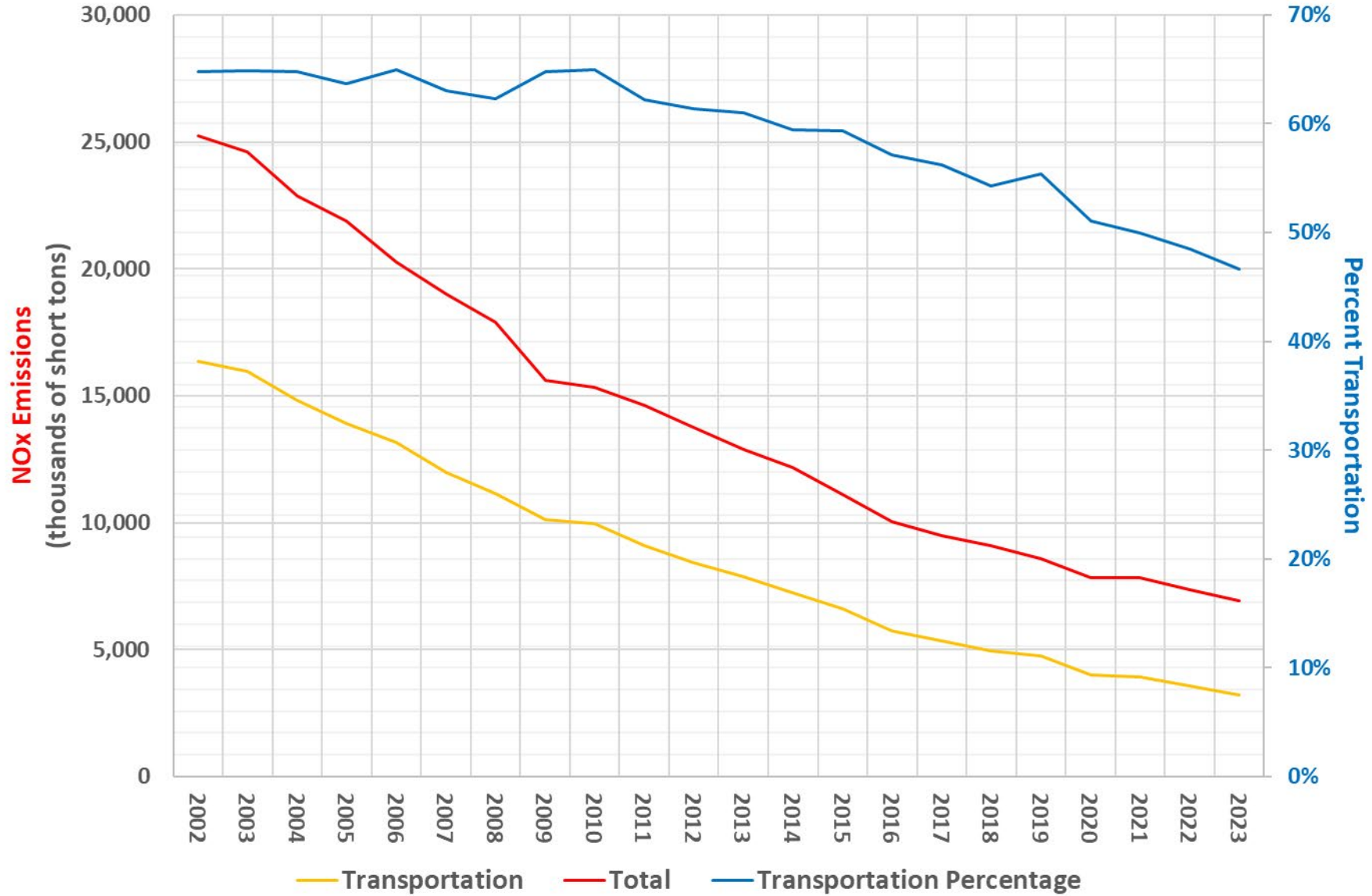
US SO₂ Emissions by Sector 2000 - 2023



US NOx Emissions by Sector 2000 - 2023



US NOx Emissions - Transportation Percentages 2002 - 2023

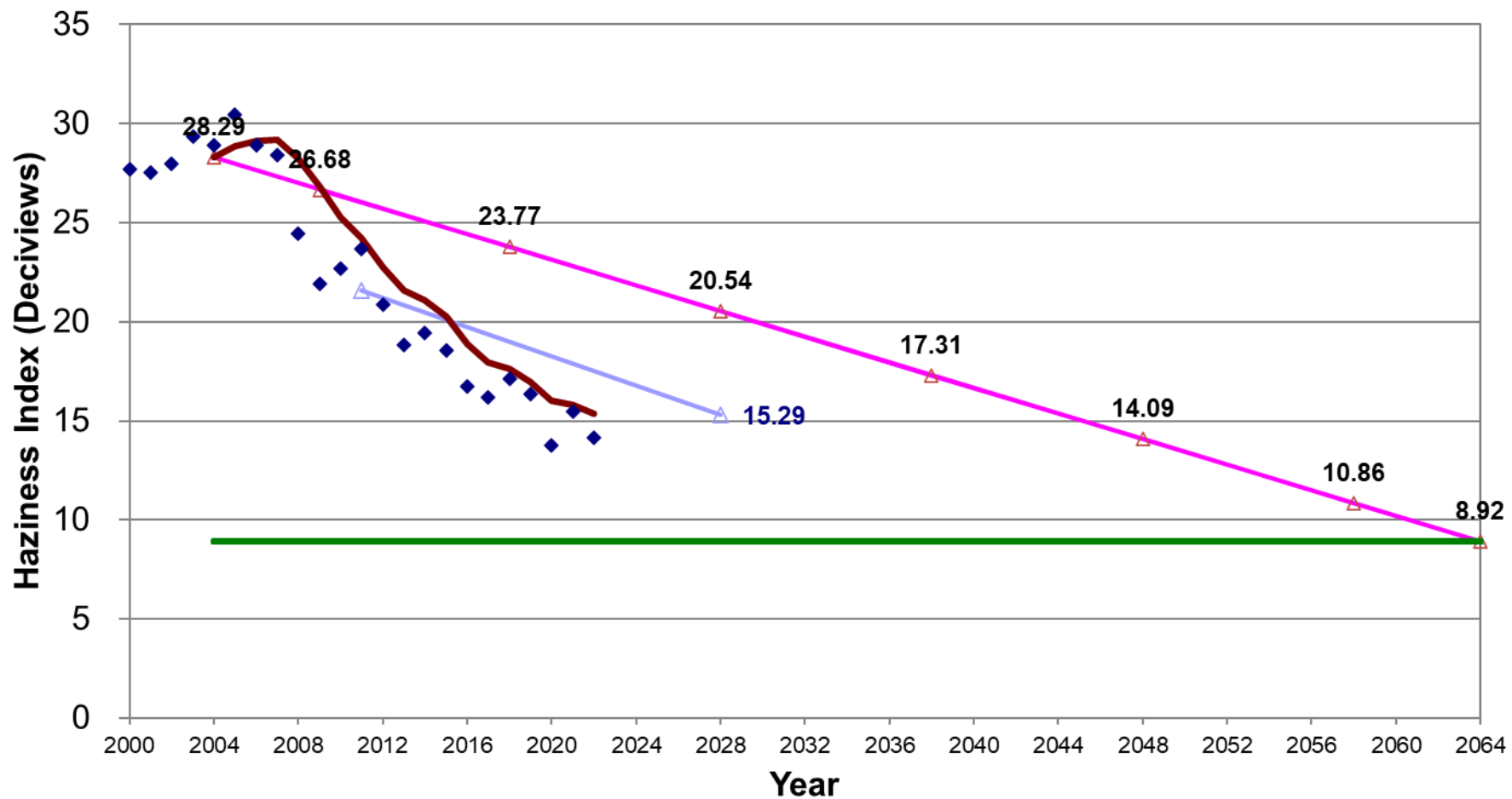


Regional Haze Round 1

Primary Drivers of Recent SO₂ & NO_x Reductions

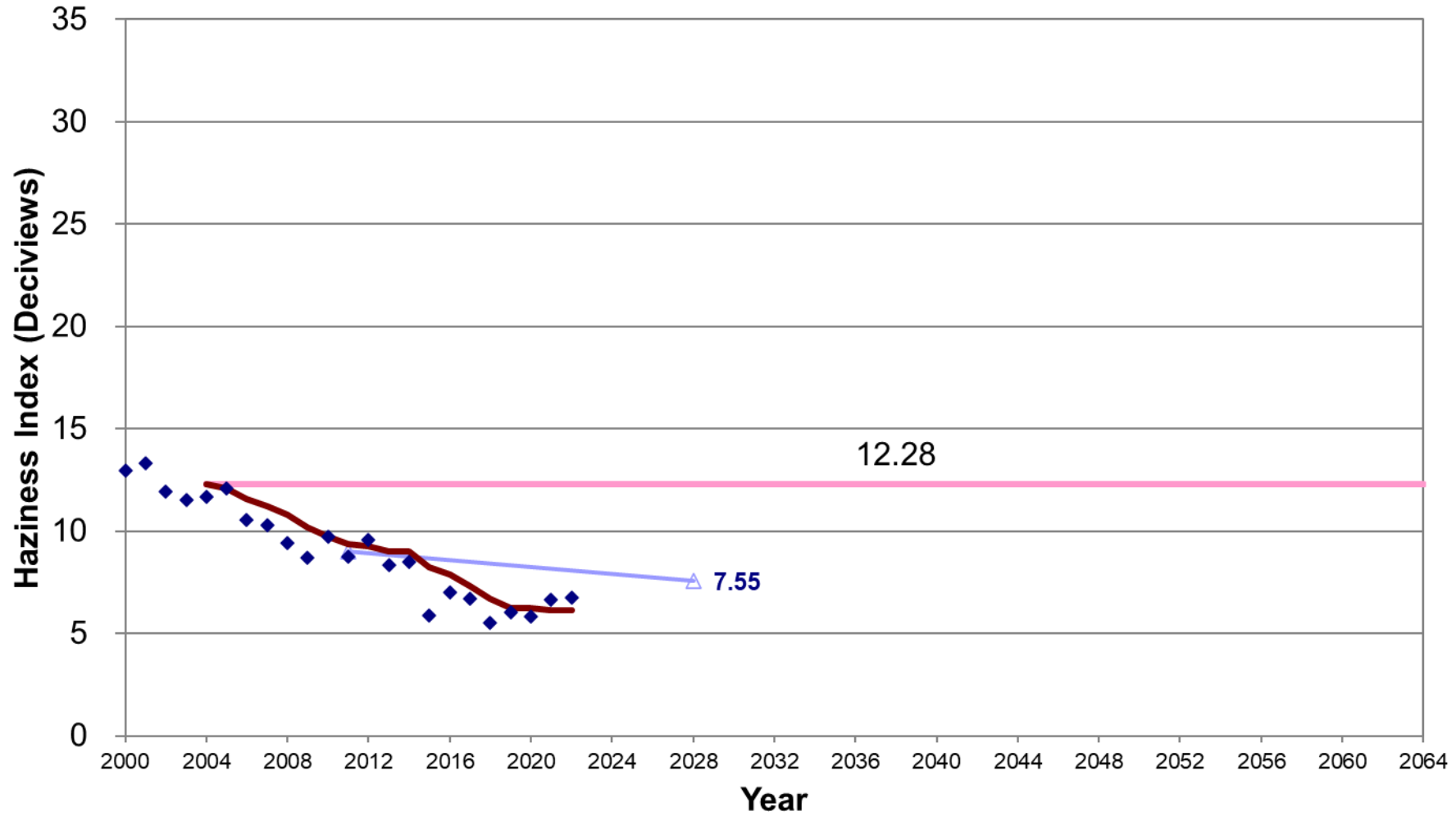
- Smaller uncontrolled coal EGU retirements (NSR suits, economics)
- Larger EGUs added controls (CSAPR, MATS, economics)
- Flood of cheap abundant shale gas – fossil EGU shifts from coal/oil to natural gas (economics and generation flexibilities)
- Tighter mobile emissions standards (federal mobile emissions standards)
- *Future*: increased utilization of renewables and maybe next generation fission
- *Future*: mobile source emissions decreases from tighter limits, more hybrids, and electrification

URP, Monitoring Data, and Visibility Projections Dolly Sods - 20% Most Impaired Days



- △ Glide Path
- ◆ Observation (Most Impaired)
- Rolling Average (Most Impaired)
- Natural Condition (Most Impaired)
- △ Model Projection (Most Impaired)

Annual and Rolling 5-Year Average Data Dolly Sods - 20% Clearest Days



- 2000-2004 Baseline Condition (Clearest)
- ◆ Observation (Clearest)
- △ Model Projection (Clearest)
- Rolling Average (Clearest)

West Virginia - Second Planning Period

AKA: Round 2

Regional Haze: West Virginia Round 2

- VISTAS narrative template and modeling
 - *Area of Influence (Aoi) analysis for source selection*
 - *Particulate Source Apportionment Technology (PSAT) modeling for selection of sources for further reasonable progress analysis*
- Model input: 2009 - 2013 IMPROVE monitor data
- Model input: historical point source emissions (2011), boundary conditions
- Model output: 2028 emissions and IMPROVE monitor visibility impacts
- Sources $\geq 1.00\%$ visibility impact thresholds selected for further reasonable progress analysis
- SO₂ remained the primary driver of visibility impairment

Regional Haze: West Virginia Round 2

- No industrial coal-fired boilers remain in West Virginia, only EGUs
- Other SO₂ & NO_x point sources are comparatively insignificant to EGUs
- WV selected 14 coal-fired EGUs at 6 facilities for further reasonable progress (four-factor analyses) for SO₂
- No WV facilities were selected by modeling for NO_x
- One selected facility is a very small gob (coal waste) combustor with comparatively small SO₂ emissions; barely met threshold, impossible to add BART SO₂ controls, so deselected

Regional Haze: West Virginia Round 2

- Requested remaining 5 coal EGU facilities to perform four-factor analyses for SO₂ controls
- *Anticipated nature of responses as all selected units already have BART FGD controls*
- One facility performed full four-factor analysis for SO₂ and determined existing FGD controls were already BART and replacement not cost effective
- All selected facilities stated the IMPROVE monitors are significantly under the uniform rate of progress (URP) line, units already have BART SO₂ controls, and all units near end-of-life

Regional Haze: West Virginia Round 2

- EPA PN comment: need four-factor analyses for SO₂ controls, even though all units have BART controls
- WVDAQ performed four-factor analyses for all units (cost, time to install, energy/non air impacts, remaining useful life)
- *Utilized historical coal shipment sulfur content from EIA, historical SO₂ emissions from CAMPD to calculate historical average control efficiencies, & historical capacity factors*
- *Used EPA IPM Summer 2021 Reference Case*
- *Assumed new controls to have 98% control efficiency*
- *Projected out 20 years operation at historical capacity factors (optimistic lifespan/operation assumption for selected units)*
- *Stopped at cost analysis (all units at selected facilities already have BART FGD)*

Regional Haze: West Virginia Round 2

- *Most units already historically controlled at greater than respective EPA NEEDS listed rates; worst: 1.3% less than NEEDS*
- All selected units have recent historical SO₂ control of >95%
- Several units already achieving recent historical SO₂ control of >98%
- Assumed new SO₂ controls achieve 98% control average
- *Controls replacement costs ranged from >\$101 million to >\$1,445 million*
- *20-year O&M costs ranged from >\$52 million/year to >\$303 million/year (most O&M costs are already in place)*
- >\$6 billion over 20 years to reduce total SO₂ emissions by 188,000 tons TOTAL (>\$32,000/ton average)

Regional Haze: West Virginia Round 2

- Unofficial Region 3 feedback: West Virginia may ask sources to take lower SO₂ limits near actual recent historical emission rates; could be lb/mmBtu rate limits
- Nothing officially in writing from Region 3
- Company responses: thanks, but no thanks...concerns -
 - *Short inconsequential emissions spikes could be excessively punitive (EPA SSM SIP Call)*
 - *Future generation needs and regulatory uncertainties; operational flexibility; grid reliability*
 - *Require \$billions and years lost generation to replace operational BART controls*
 - *Existing FGD systems CANNOT be switched off*
 - *Average fleet age – near end of life*
 - *Units are already required per federally enforceable T5 permits to minimize emissions as much as practical/safely possible*
- Waiting on EPA to (assumedly) deny our round 2 SIP

Round 3: Non-Regulatory Docket

- Spring 2023 Unified Agenda: Regional Haze
- EPA opened non-regulatory docket for the RHR on March 28, 2024
<https://www.regulations.gov/docket/EPA-HQ-OAR-2023-0262>
- EPA will consider comments submitted by June 28, 2024
- Comment period ends on December 31, 2024, but EPA may not consider comments submitted after June 28, 2024
- EPA seeking feedback on potential changes to the RHR
- EPA held an informational webinar on April 9, 2024

Round 3: SESARM/VISTAS Letter to EPA (2023-07-14)

1. Streamline the Scope of the SIP Revisions (*Clarify SIP requirements*)
2. End-of-Life for Stationary Source Four-Factor Analyses (*Stationary sources will not always be drivers of impairment*)
3. Non-Traditional Four-Factor Analyses (*Mobile and non-point sources are having increased visibility impact*)
4. Glideslopes Ahead of Schedule (*Guidance for reasonable progress and LTS when areas are near natural conditions*)
5. Regional Haze Rule End-of-Life (*Areas near natural conditions: must states continue to update SIPs?*)
6. Integration of New NAAQS Requirements (*LTS guidance regarding the revised annual PM_{2.5} NAAQS*)

Round 3: SESARM/VISTAS Letter to EPA (2023-07-14)

7. Off-Ramp for Effectively Controlled Sources (*Pull out of guidance and include the RHR for certainty*)
8. URP Adjustments (*Allow for adjustments for wildfires and agricultural NH₃*)
9. Define Meaningful Engagement (*Clarify meaningful engagement, EJ, and cumulative impact analysis since not in the RHR, as visibility is NOT a health-based NAAQS*)
10. Integration of Four-Factor Analyses in Permitting Programs (*Develop mechanism for state credit of LTS for permitting programs*)
11. Streamlining of Regional Haze Guidance (*A single easy to follow inclusive guidance mechanism*)

Round 3 VISTAS Poll: Concerns/Wishlist

1. EPA should focus on visibility improvements rather than emissions inventories.
2. Sources shouldn't be required to complete four-factor analyses if they have no reasonable (significant) impact on a Class I area.
3. EPA should define what visibility improvement is significant enough to justify controls investment. (Cost/deciview or some other metric?)
4. PSAT is a superior modeling approach than Aol or Q/d analysis. EPA knows and should admit this fact.
5. The round 2 process was onerous for minimal or no gain in visibility improvement. The rule should be streamlined.

Round 3 VISTAS Poll: Concerns/Wishlist

6. For the second planning period, EPA became concerned over issues it did not mention during comment periods. Some issues were only verbally expressed until EPA was pressed by states to put concerns into formal writing.
7. EPA pushed NO_x late in the process or claimed states did not evaluate NO_x, when VISTAS modeling demonstrated NO_x did not meet the selected visibility impairment threshold. SO₂ is still the largest contributor to visibility impairment, and NO_x emissions are still dominated by mobile sources, which states have little to no control over.
8. The earliest round 2 SIPs have been at EPA for nearly three years and have not yet been acted upon.
9. EPA claims RH SIP review delays for “national consistency” but this seems in opposition to the very definition of a SIP.
10. EPA push for electrification of everything will increase demand for electricity, and quite possibly initially will cause a temporary *increase* in fossil generation and SO₂/NO_x emissions until renewable generation assets are mature.