Electricity Committee

NARUC Summer Policy Summit

(Trans)Mission Critical? Reconsidering FERC's Electric Transmission Incentives

NARUC Summer Policy Summit

Moderator:

Hon. Judith Williams Jagdmann, Va.

Phil Moeller, EEI

Suedeen Kelly, Jenner & Block, LLP

Delia Patterson, APPA

NARUC Summer Policy Summit

Electricity Committee

Up Next at 1:30…

100% Clean Energy:
What Comes Next for Regulators?

(Joint with Committee on Energy Resources & the Environment)

NARUC Summer Policy Summit

100% Clean Energy:
What Comes Next for Regulators?

Electricity Committee

Committee on
Energy Resources & the Environment

NARUC Summer
Policy Summit

Moderator:

Leia Guccione, RMI

Hon. James Griffin, Hawaii

Sandra Mattavous-Frye, D.C. People's Counsel

Jeff Lyng, Xcel

NARUC Summer Policy Summit

Electricity Committee

Up Next at 2:45…

100% Clean Energy:
What Comes Next for Markets and the Grid?

(Joint with Committee on Energy Resources & the Environment)

NARUC Summer Policy Summit

100% Clean Energy:
What Comes Next for Markets and the Grid?

Electricity Committee

Committee on
Energy Resources & the Environment

NARUC Summer
Policy Summit

Moderator:

Debbie Lew

John Moore, NRDC

Armond Cohen, Clean Air Task Force

Mason Emnett, Exelon

NARUC Summer Policy Summit

Up Next at 4:00…

Beyond Retirements: How Carbon Capture, Utilization, and Storage Can Save Ratepayers Money

Subcommittee on Clean Coal and Carbon Management

NARUC Summer Policy Summit

Beyond Retirements: How Carbon Capture, Utilization, and Storage Can Save Ratepayers Money

Subcommittee on Clean Coal and Carbon Management

NARUC Summer Policy Summit

Moderator:

Hon. Jeremy Oden, Alabama

Chuck McConnell, University of Houston

Mike Nasi, Jackson Walker

Paul Bailey, American Coalition for Clean Coal Electricity/America's Power

NARUC Summer Policy Summit

Mike Nasi
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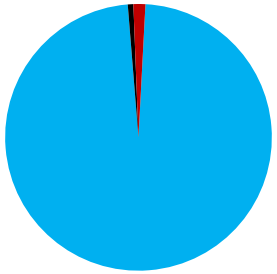
Executive Director,
Carbon Management and Energy Sustainability
UH Energy, Chancellor/President's Division
832-922-5799
cmcconnell@uh.edu

The Low Carbon Role for Coal

Why Carbon Capture Utilization & Storage (CCUS) Must be a Part of Resource Planning

NARUC Summer Meeting
Indianapolis, Indiana
July 22, 2019

The Low Carbon Role for Coal
DISCUSSION OUTLINE



- The Difference Between “Safe” and “Clean”
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The Low Carbon Role for Coal
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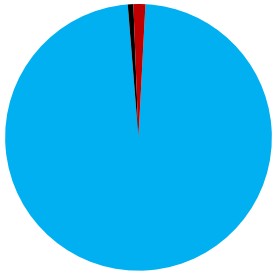

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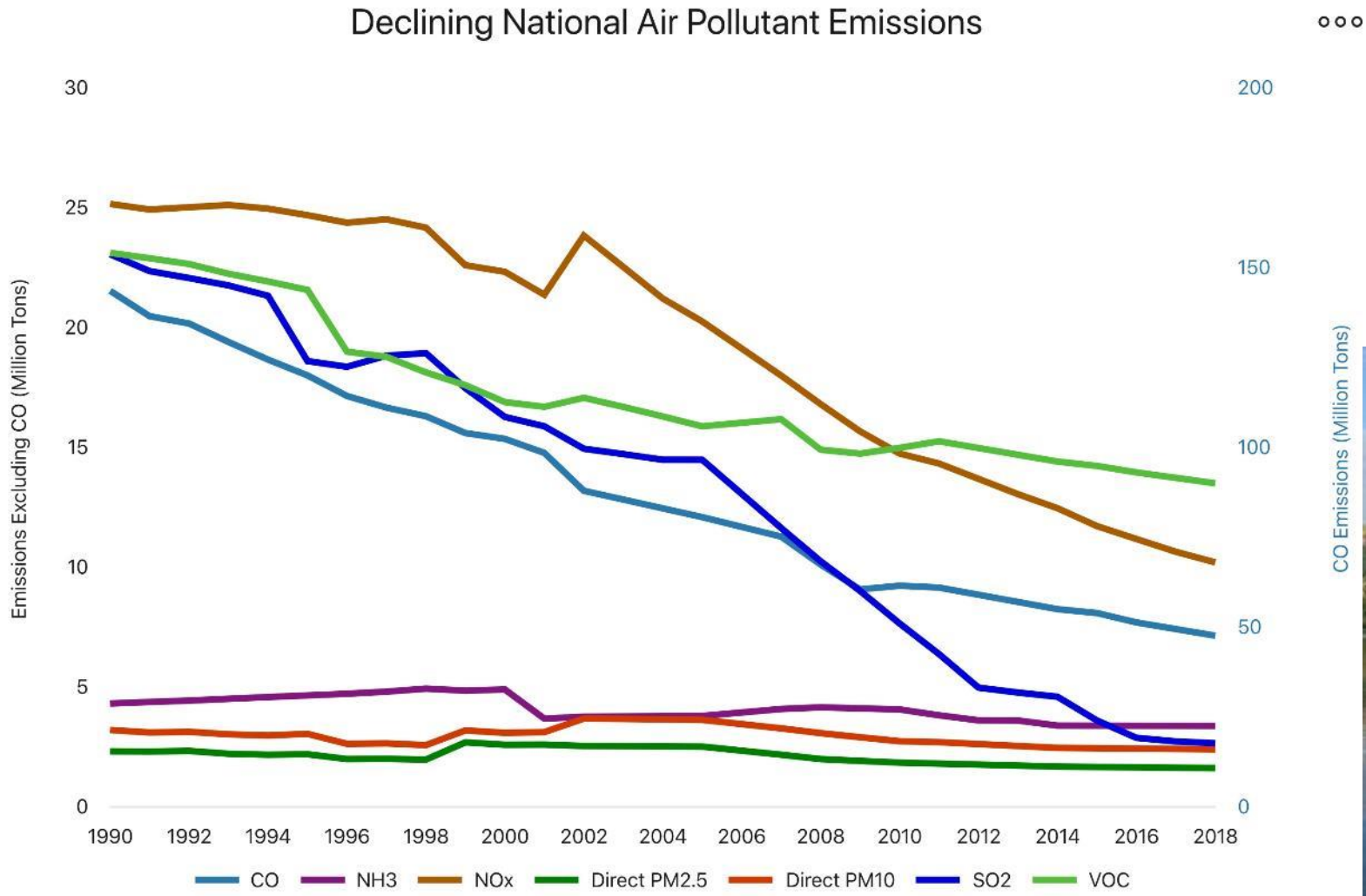
Then and Now: 50 Years of Success -

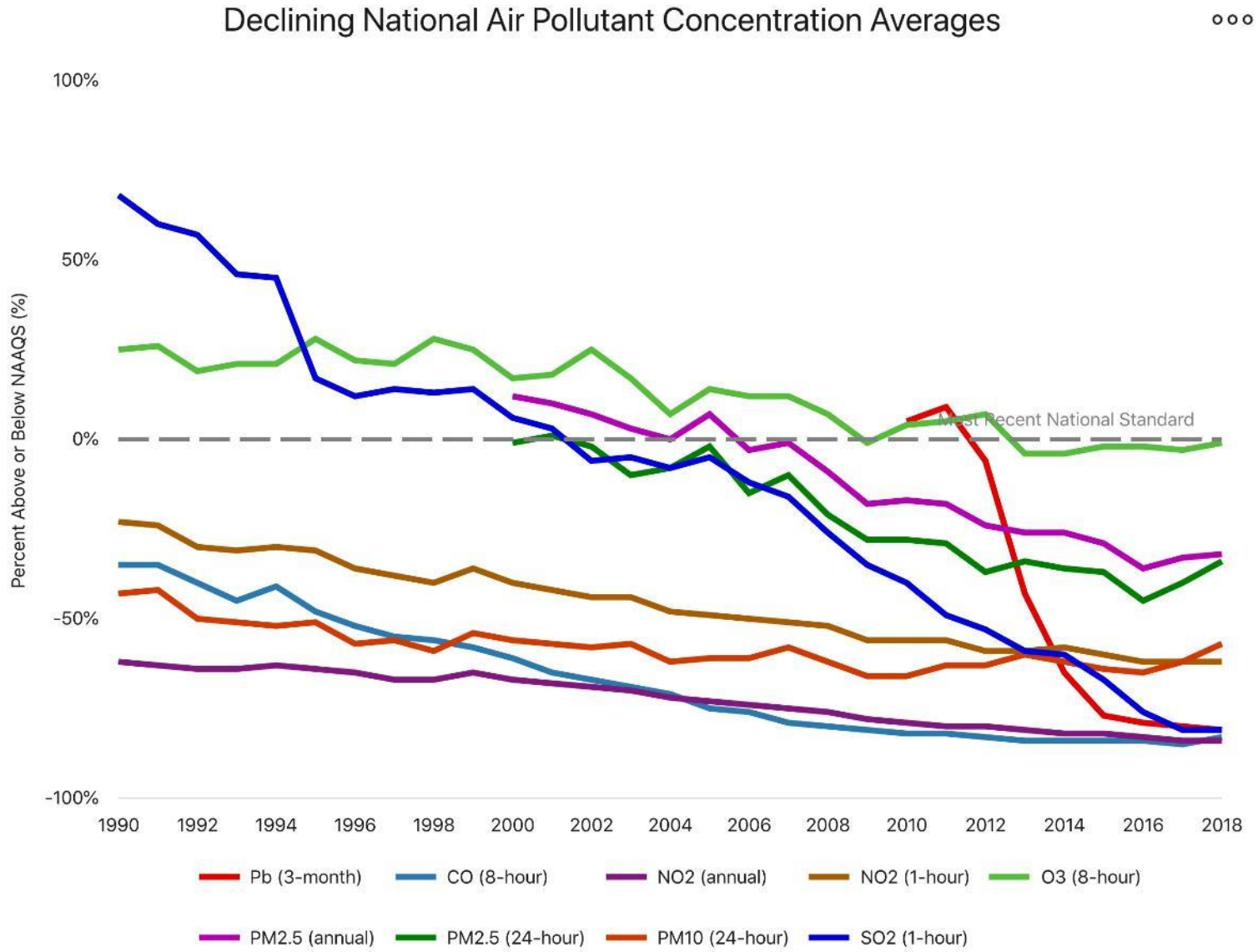
We Internalized the Externalities of Pollution



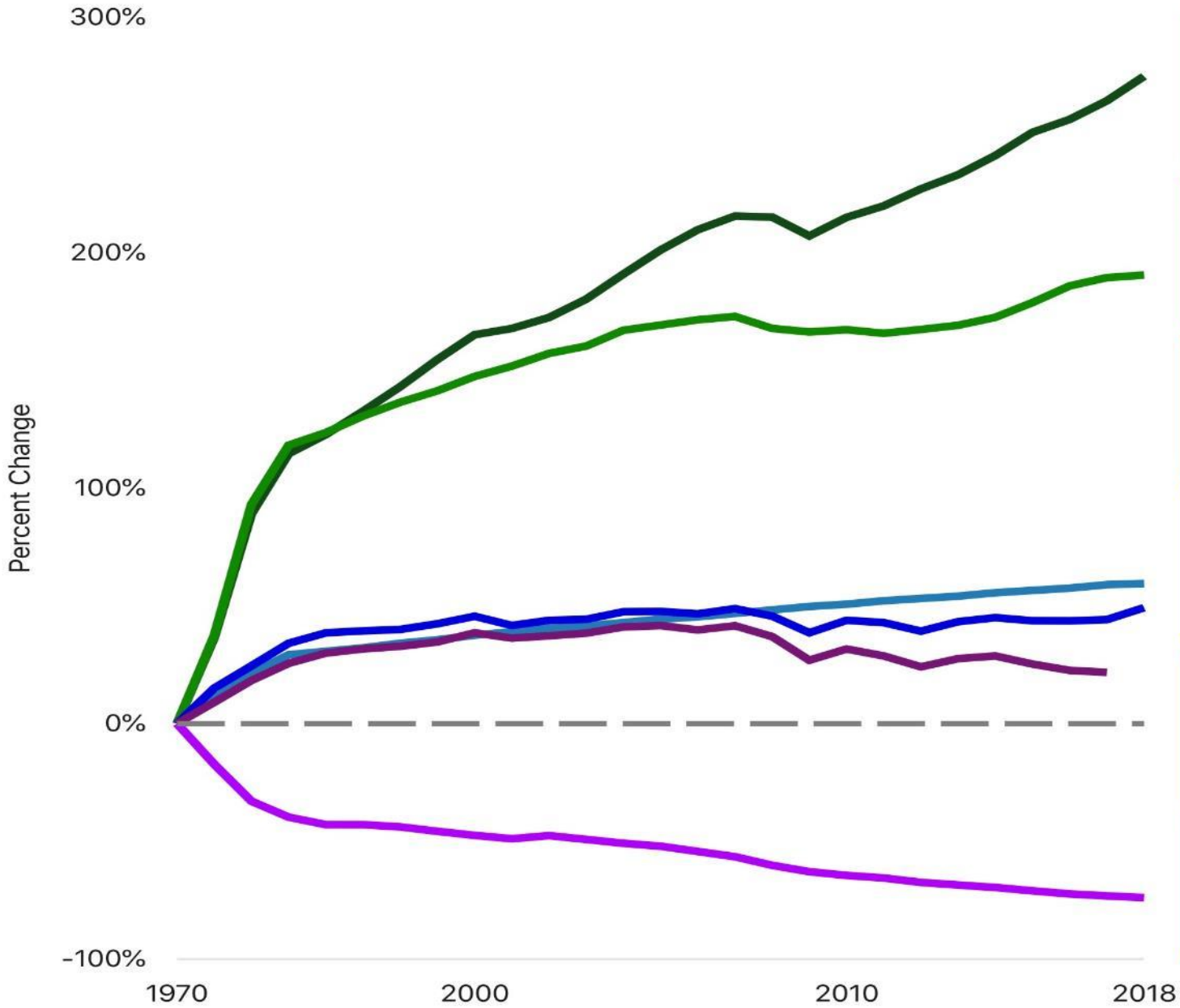
Source: U.S. EPA National Emissions Inventory 2014 ver. 2

Then and Now: 50 Years of Success -

We Internalized the Externalities of Pollution



Comparison of Growth Areas and Declining Emissions
1970-2018




Gross Domestic Product


Vehicles Miles Traveled

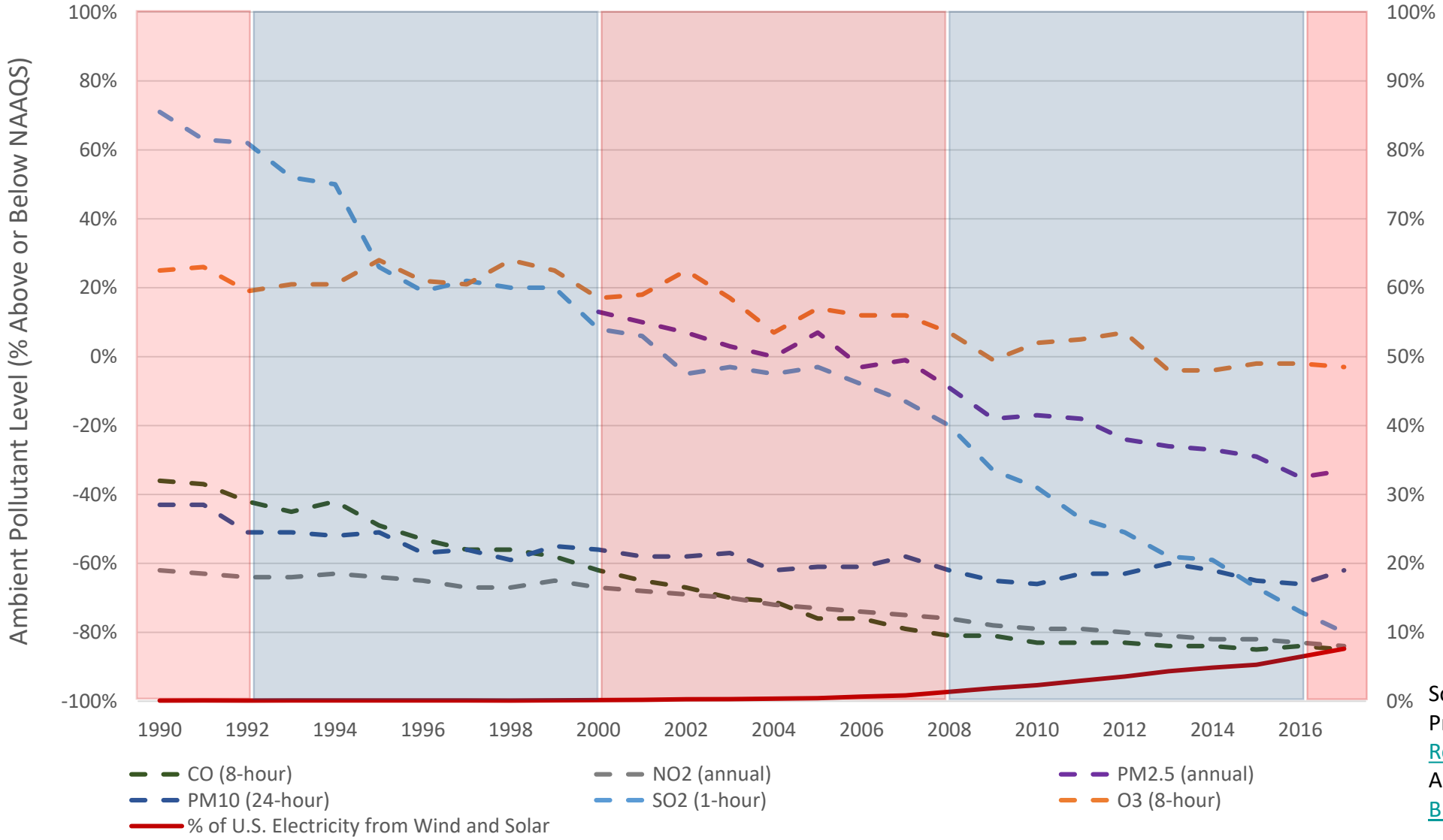

Population


Energy Consumption


CO_2 Emissions

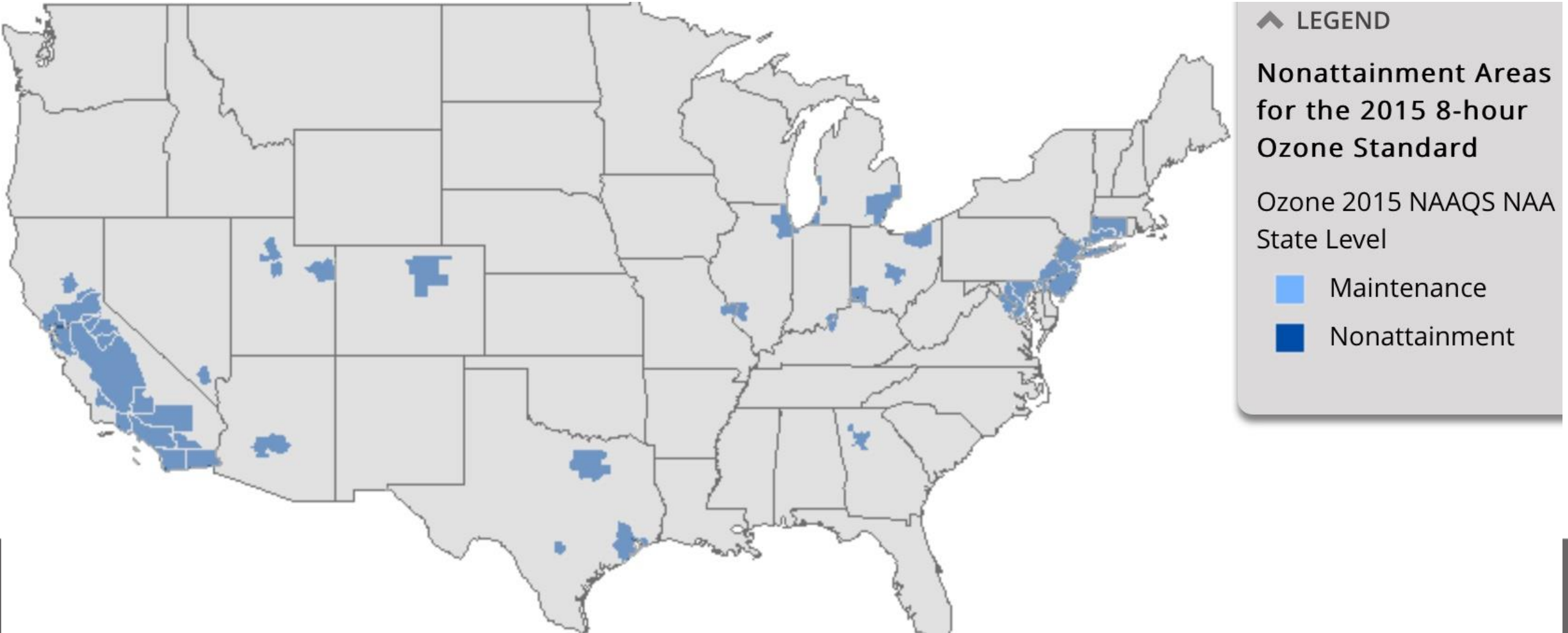

Aggregate Emissions
(Six Common Pollutants)

We Made our Air Safe with Technology, Not Anti-Fossil Fuel Ideology

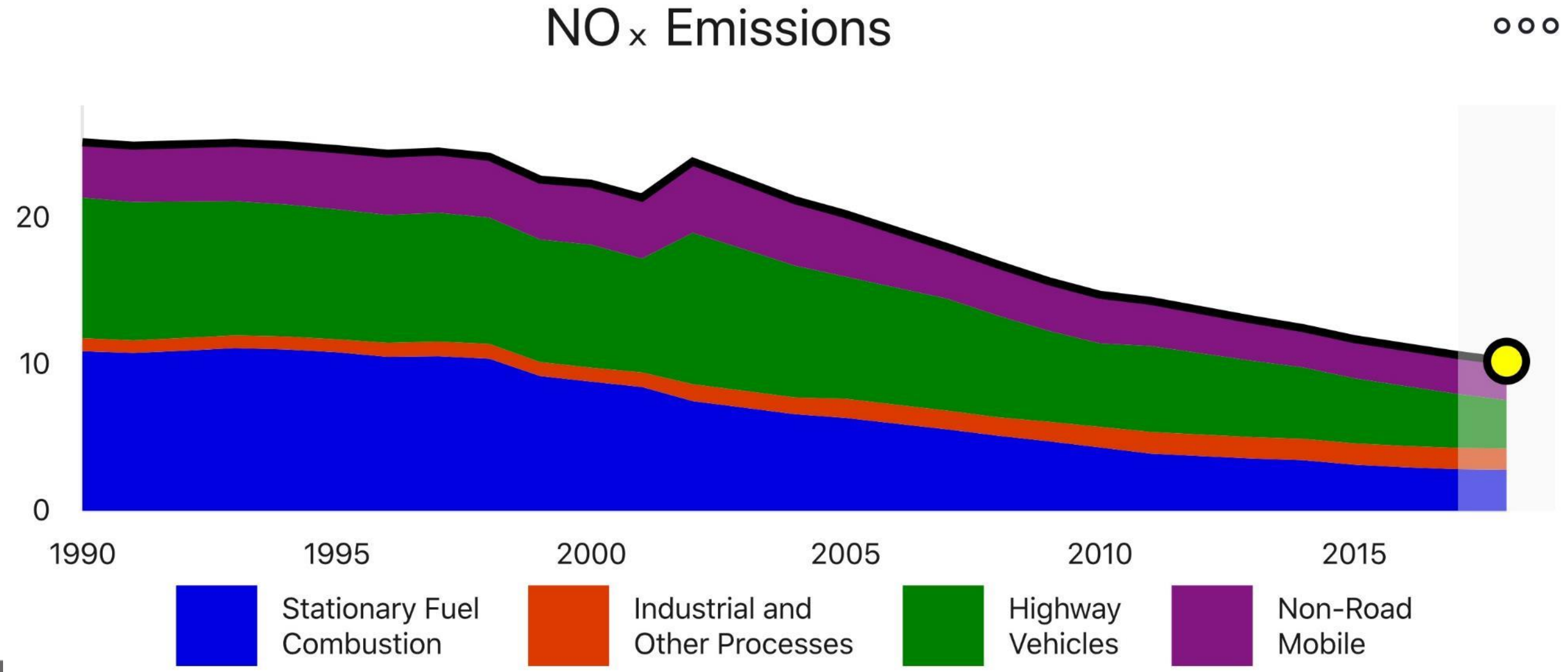


Sources: Environmental Protection Agency, Air Trends Report 2018; Energy Information Administration, Total Energy Data Browser

CASE STUDY: OZONE NONATTAINMENT

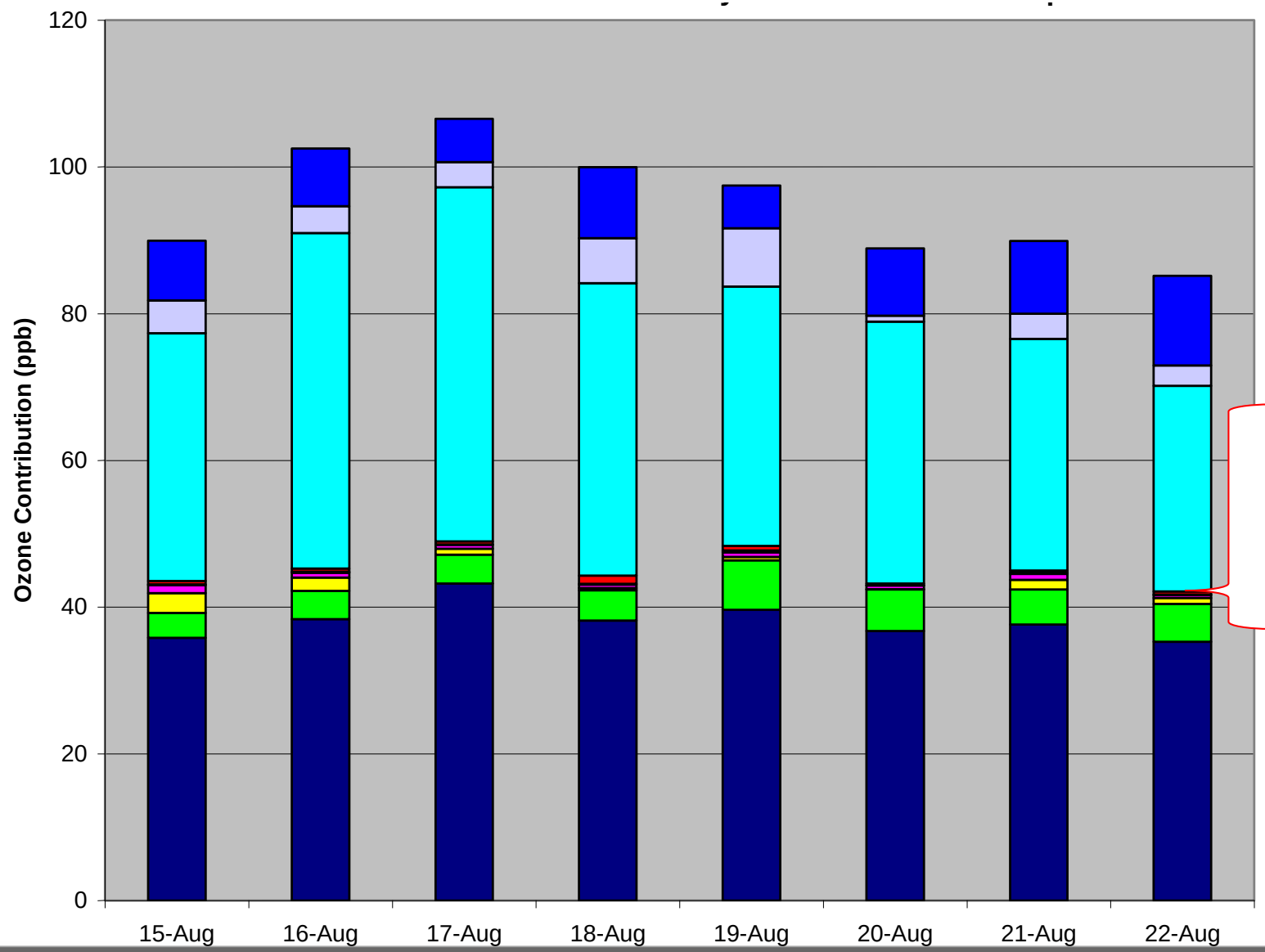


Power Plants No Longer Drive Nonattainment



Source: U.S. EPA National Emissions Inventory 2014 ver. 2

EXAMPLE – DFW: Power Plants Have Not Driven Attainment Status for over a decade



- Non-TX Anthro
- TX (outside DFW) non-EGU anthro
- DFW non-EGU anthro
- Other TX EGUs
- EGUs within 200km
- EGUs within 100km
- DFW 9-County EGUs
- Nine Large EGUs
- Biogenics
- IC/BC

Very Small Local & Regional Power Plant Contribution

Source: July 13, 2006 TCEQ Presentation to Senate Natural Resource Committee

CASE STUDY: $PM_{2.5}$ NONATTAINMENT

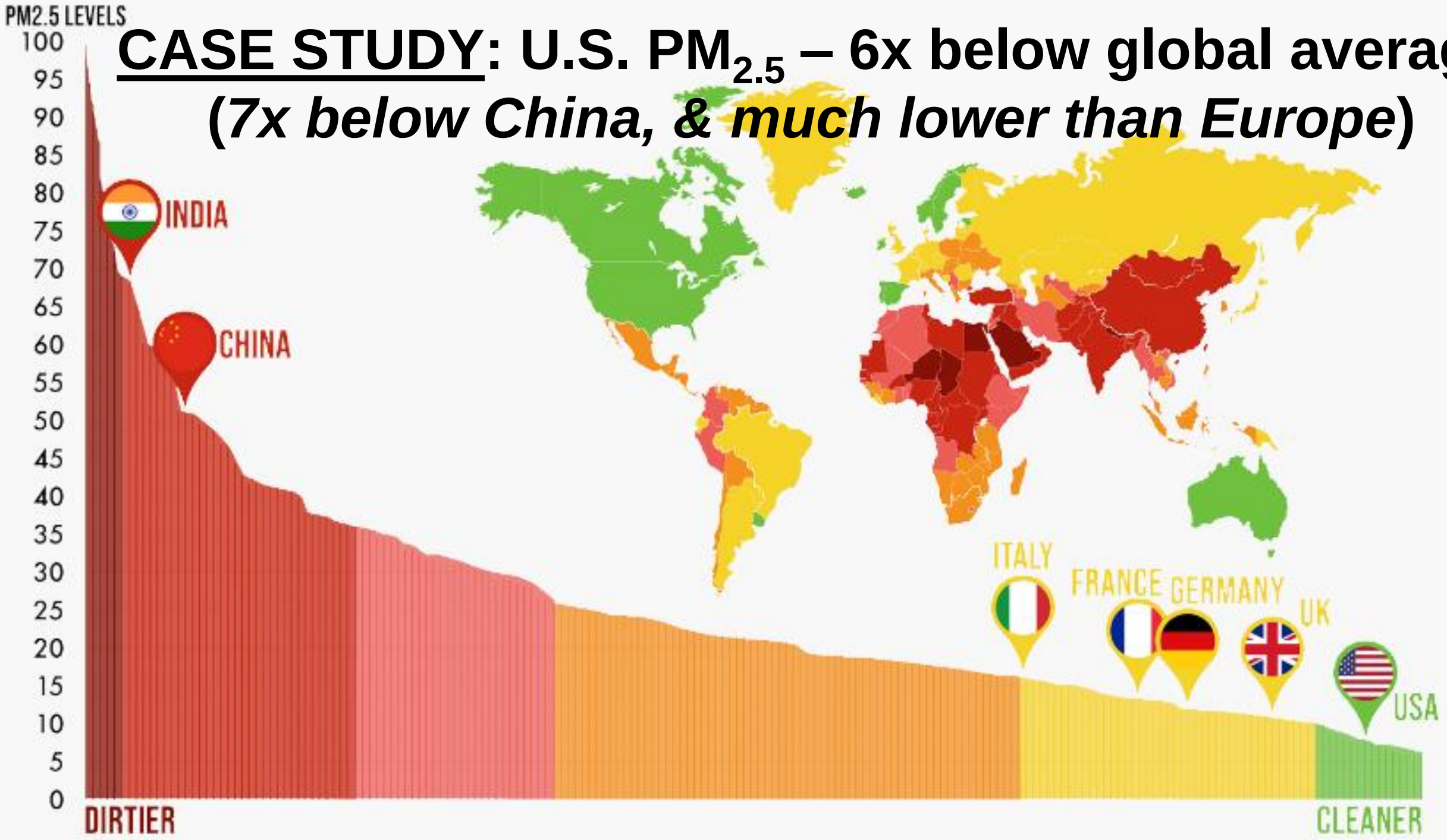
LEGEND

Nonattainment Areas for the 2012 Annual Fine Particle (PM2.5) Standards

PM2.5 Annual 2012 Nonattainment Areas

- Maintenance
- Nonattainment

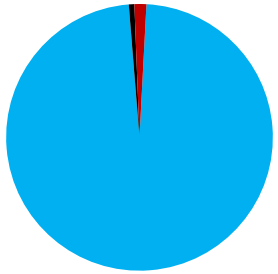
CASE STUDY: U.S. $PM_{2.5}$ – 6x below global average (*7x below China, & much lower than Europe*)



For Non-GHGs, When Ambient Air Quality is "Safe," We Should NOT Count Benefits for "Cleaner"

- Per the FCAA, NAAQS are based on what is considered a "safe" level of constituents for humans (plus a margin of safety).
- Only NAAQS nonattainment remaining in the U.S. is NOT being driven by power plants (natural/foreign/mobile sources).
- Thus, it is inappropriate to continue assuming "benefits" from lowering power plant emissions down to absolute zero.
- Yet, 99% of "benefits" of EPA air rules assumed by the prior administration were derived from reducing ambient levels below the NAAQS "safe" levels.

The Low Carbon Role for Coal
DISCUSSION OUTLINE



- The Difference Between “Safe” and “Clean”
- *Carbon Reductions are Not all Created Equal*
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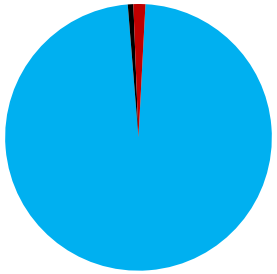
- CCUS in Resource Planning

Not All Carbon Reductions are Created Equal

- Early retirement of well-controlled coal units rarely economically justified.
- State & Federal subsidies and mandates for renewables has already been a significant internalizing function of carbon as an externality.
- Because carbon captured from a dispatchable fossil fuel plant innovates CCUS & provides baseload low-carbon power, it is a much more valuable low-carbon asset (to the grid & the world) than intermittent wind or solar.
- If we are serious about mitigating anthropogenic CO2 & ensuring market transparency, regulatory approvals/planning must ensure that ratepayers know the true and total cost (and benefits) of their low-carbon options.

The Low Carbon Role for Coal
DISCUSSION OUTLINE



- The Difference Between “Safe” and “Clean”
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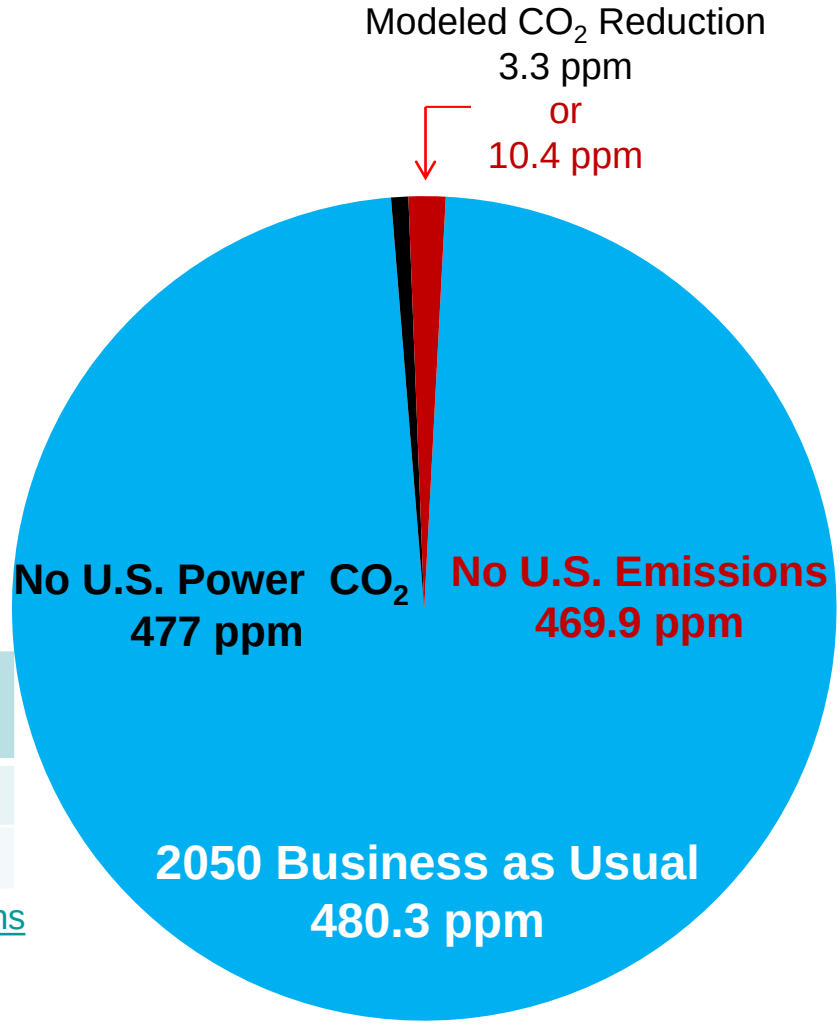
DON'T FORGET THE MATH:
The World Needs our Technology, Not Anti-Fossil Fuel Ideology

2050 IMPACT OF DECARBONIZING ELECTRICITY:

- NO COAL FLEET = 2.06 ppm (0.4%) reduction in CO_2 concentration.
- NO FOSSIL FLEET = 3.3 ppm (0.7%) reduction in CO_2 concentration.
- Modeled global temperature reduced by a mere 0.016°C.

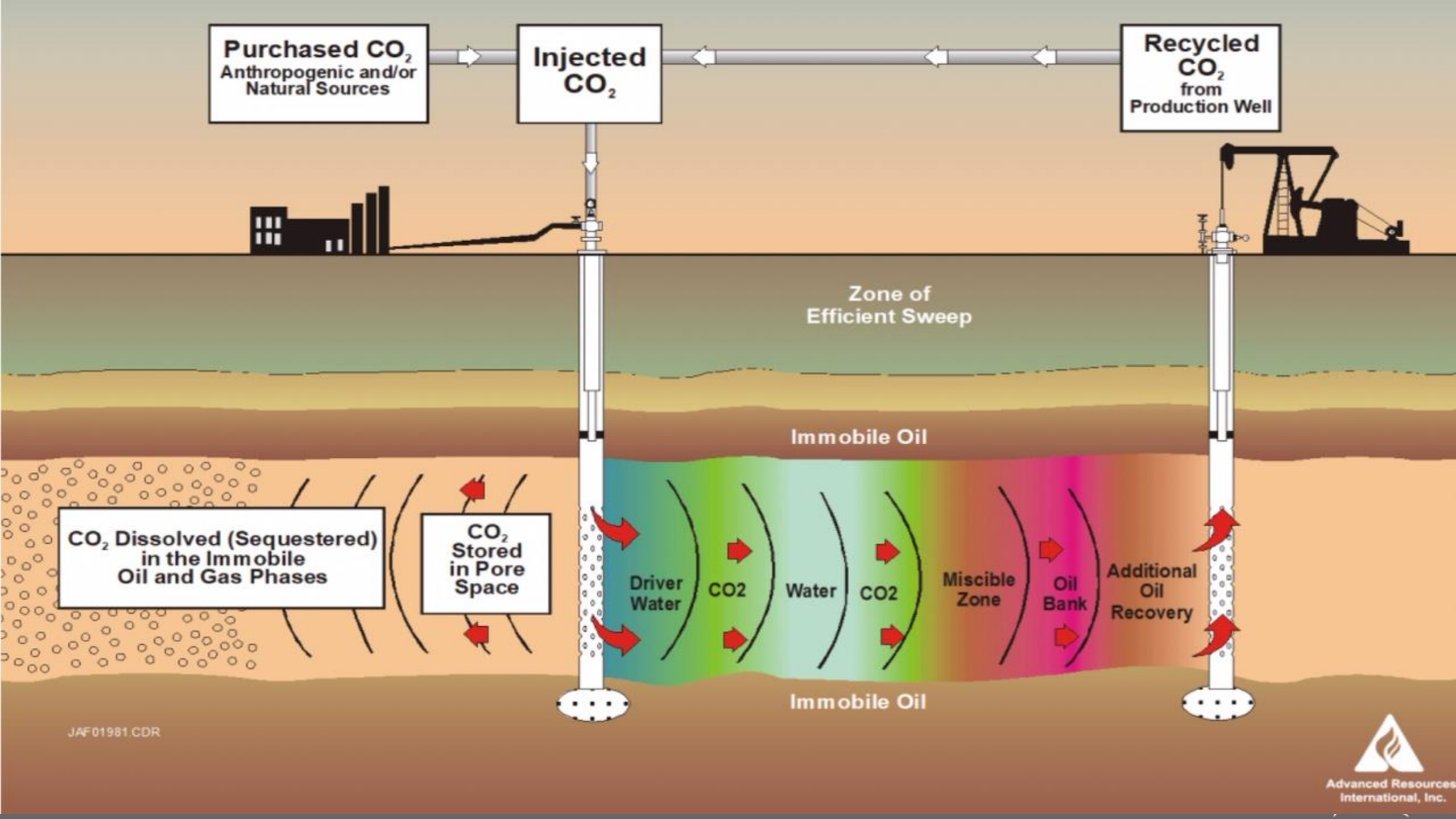
2050 IMPACT OF DECARBONIZING ENTIRE U.S.:

- 10.4 ppm (2.2%) reduction in CO_2 concentration.
- Modeled global temperature reduced by 0.053°C.



CO2 Emissions	2010	2020	2030	2040	2050	% Change
World	30,834	34,972	36,398	39,317	42,771	+38.7%
U.S.	5,571	5,260	4,839	4,867	5,071	-8.9%

Sources: Energy Information Administration, International Energy Outlook 2017, World carbon dioxide emissions by region; MAGICC6 Model; Intergovernmental Panel on Climate Change Fifth Assessment Report Working Group I, Summary for Policymakers; National Oceanic and Atmospheric Administration Global Land and Temperature Anomalies.


Purchased CO_2
Anthropogenic and/or
Natural Sources
Injected
CO_2
Recycled
CO_2
from
Production Well
Zone of
Efficient Sweep
Immobile Oil
CO_2 Dissolved (Sequestered)
in the Immobile
Oil and Gas Phases
CO_2
Stored
in Pore
Space
Driver
Water
CO2
Water
CO2
Miscible
Zone
Oil
Bank
Additional
Oil
Recovery
Immobile Oil
JAF01981.CDR
Advanced Resources
International, Inc.

Petra Nova:

Power Generation:

- Gas CT/peaker for parasitic load

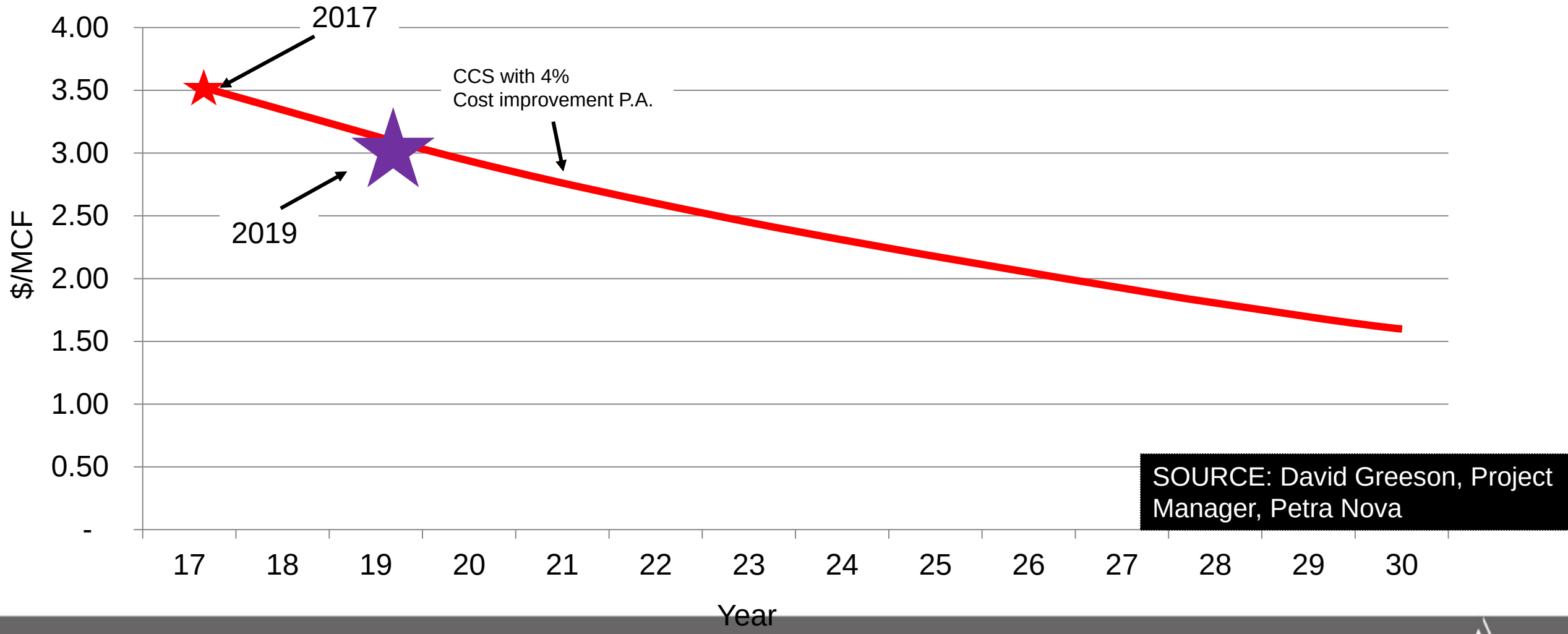
Carbon Capture:

- Post-combustion amine solvent
- 90% of 250 MW slip stream
- 1.65 short tons of CO^2 annually

Product Delivery and Utilization:

- CO^2 EOR via 80-mile pipeline
- West Ranch oil recovery up from 500 to 5,000-10,000 Barrels Per Day

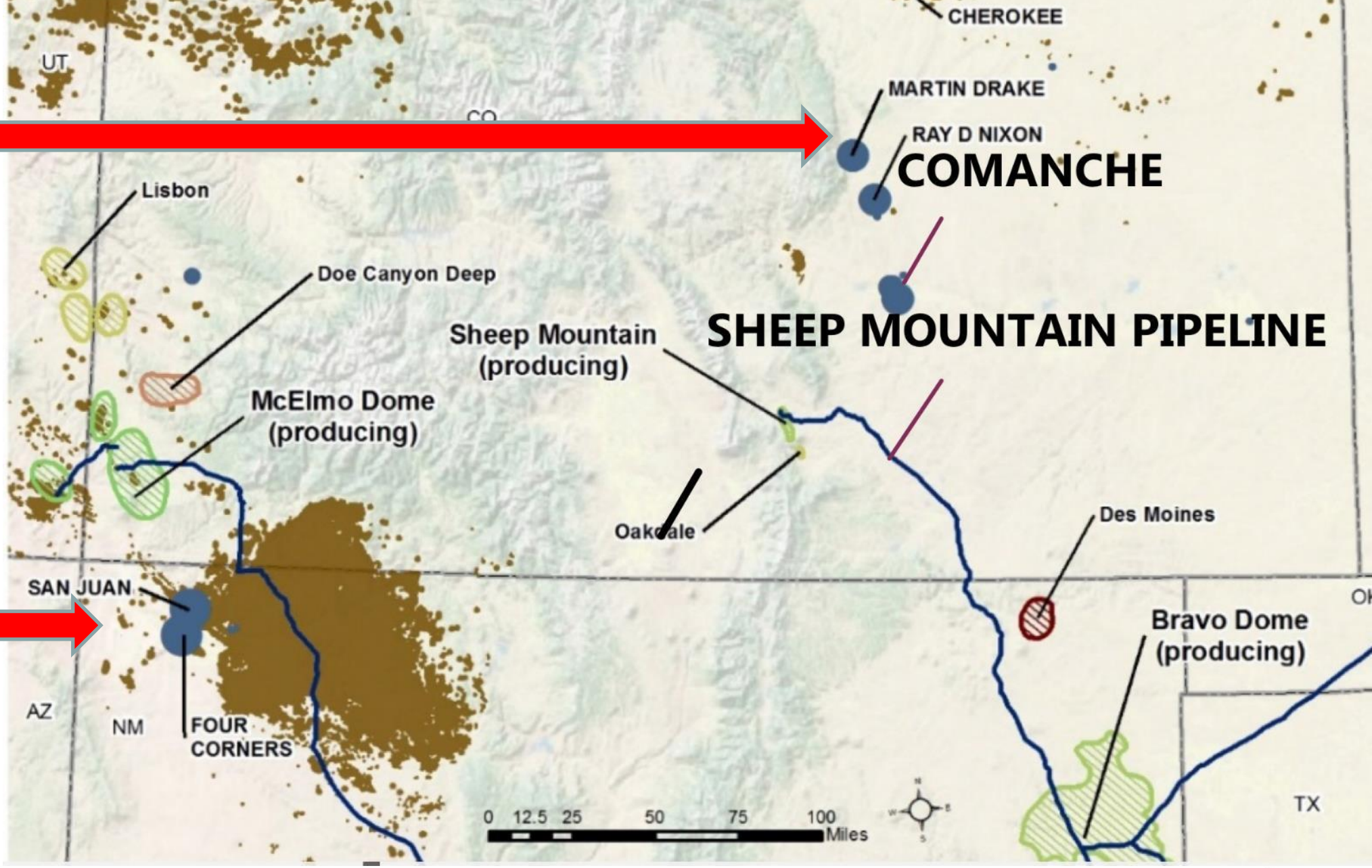
Path to success – Improving CCUS Economics



SOURCE: David Greeson, Project Manager, Petra Nova

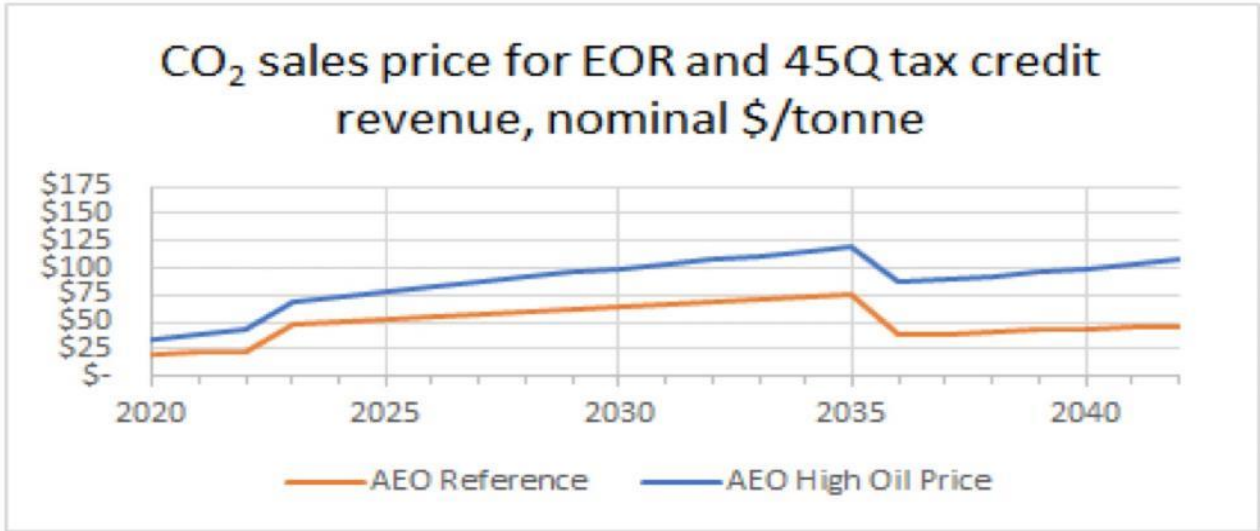
CASE STUDY:

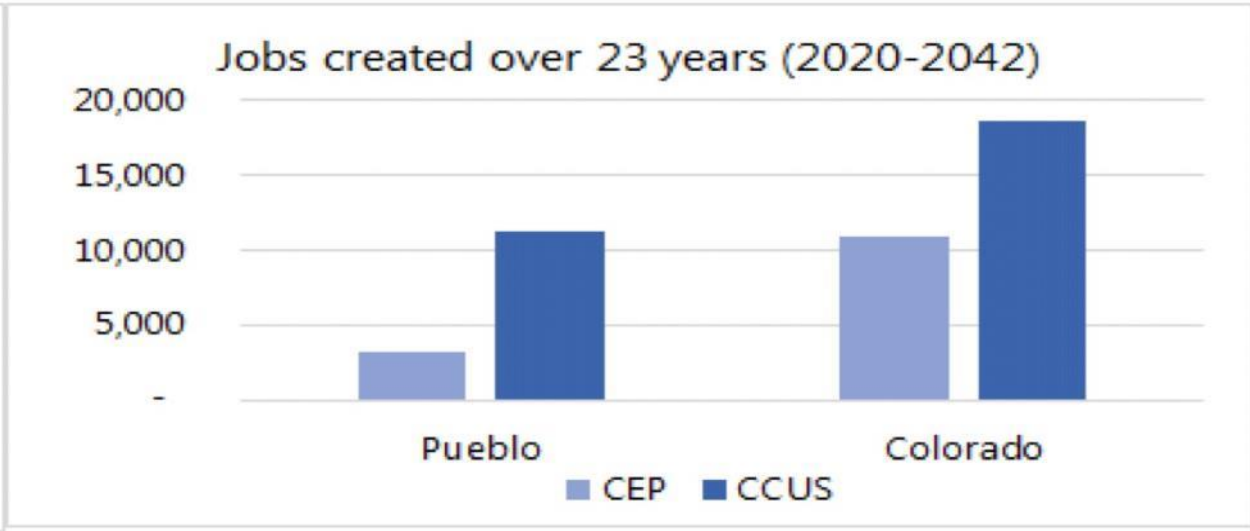
CO & NM Units that Could be Retrofitted with CCUS Rather than Retired

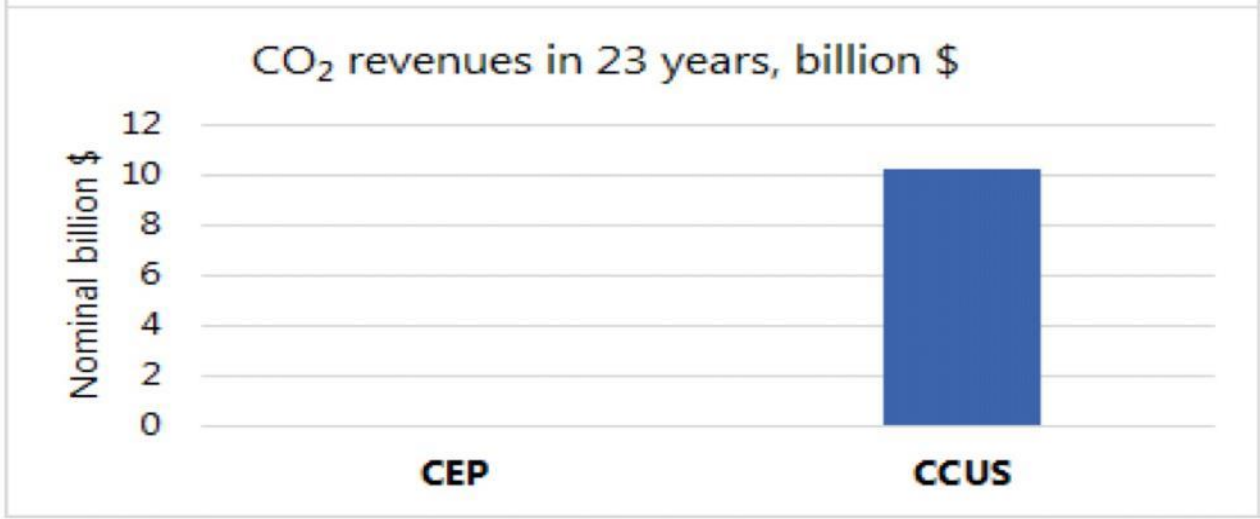


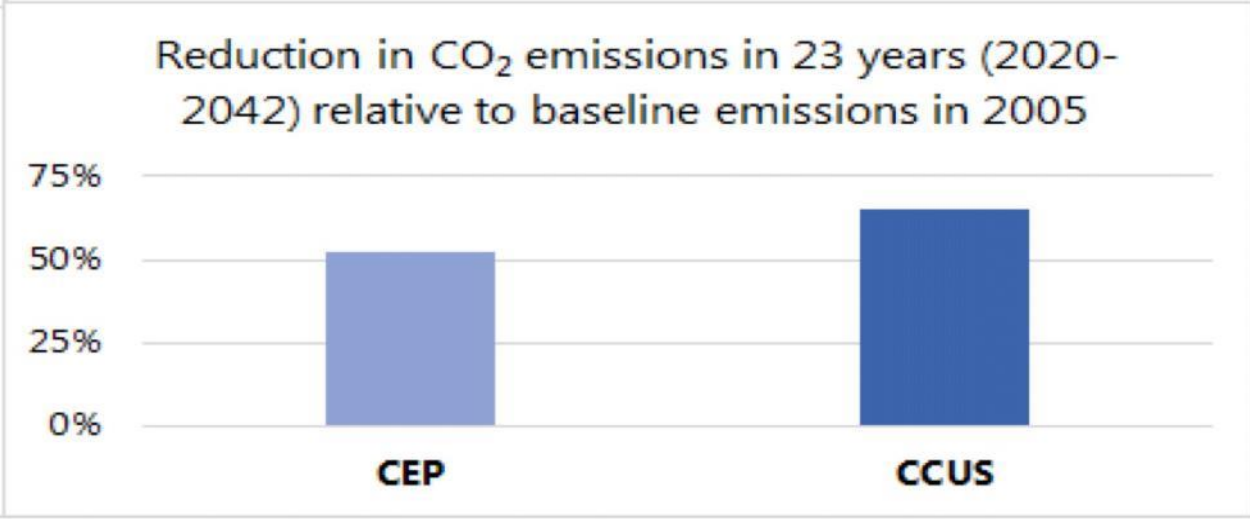
DOE STUDY: Demonstrates Viability of CCUS Retrofit Rather than Retire & Replace with Wind/Solar/Storage

(Tax Equity Owner reduces cost to the consumer even more!)

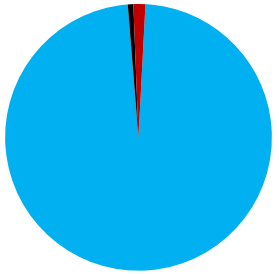








The Low Carbon Role for Coal
DISCUSSION OUTLINE



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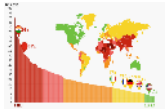
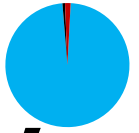
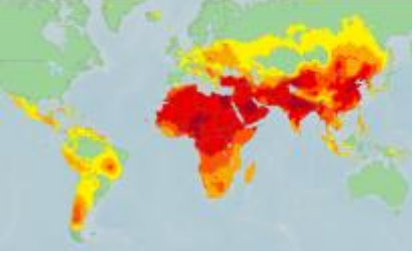


Factors That Regulators Should Address When Comparing CCUS & Renewable Energy



WIND/SOLAR/STORAGE	KEY CONSIDERATIONS	CCUS RETROFIT
• Low Capacity Factors • Transmission Additions • Reliability & Resilience Penalty	**True & Total LCOE**	• High Capacity Factors • No New Transmission • High Reliability & Resilience
• Bird Strikes • Habitat Destruction • Lithium/Cobalt Mining for Batteries • Rare Earths for Turbines & Solar	**Non-GHG Externalities**	• Air Quality Not Impacted > Known “Safe” Levels (NAAQS) • Successful & Established Coal Reclamation Programs
• Backup Power Emissions • Life-Cycle GHGs From Construction & Land Use • Missed R&D opportunity	**GHG Externalities**	• No Backup Power Required – (24/7 carbon-free resource) • R&D Drives Down Future Costs (global game changer)
• Dependence on Minerals & Products Not Mined/Made in US	**Economic Impact & Geopolitical**	• Domestic fuels (coal & gas) + export commodity (oil & tech)



The Low Carbon Role for Coal

Charles McConnell

Executive Director,

Carbon Management and Energy Sustainability

UH Energy, Chancellor/President's Division

cmcconnell@uh.edu

Mike Nasi

Mnasi@jw.com

Partner, Jackson Walker LLP

Director, Life:Powered

QUESTIONS?

“Converting Carbon to a Commodity” Video

https://www.youtube.com/watch?v=TlXVvAoQBjc

APPENDIX: *Why U.S. Power Markets are NOT Transparent*

1. **The premise of U.S. RE moving the needle on global climate change is fundamentally flawed.**
   - Even if we were to eliminate all U.S. power sector emissions by 2030, it would only reduce 2050 global concentrations by .7% (3.3 out of 480.3 ppm)
2. **PTC/ITC subsidies are hidden from consumers.**
3. **All fuels receive subsidies but there is massive disparity in Return on Investment (in $/MW).**
4. **Direct/Indirect Subsidies Distort Markets:**
   - Transmission socialized across entire markets.
   - Growing costs of balancing wind & solar.
   - Stranded costs & lack of market signals for capacity.

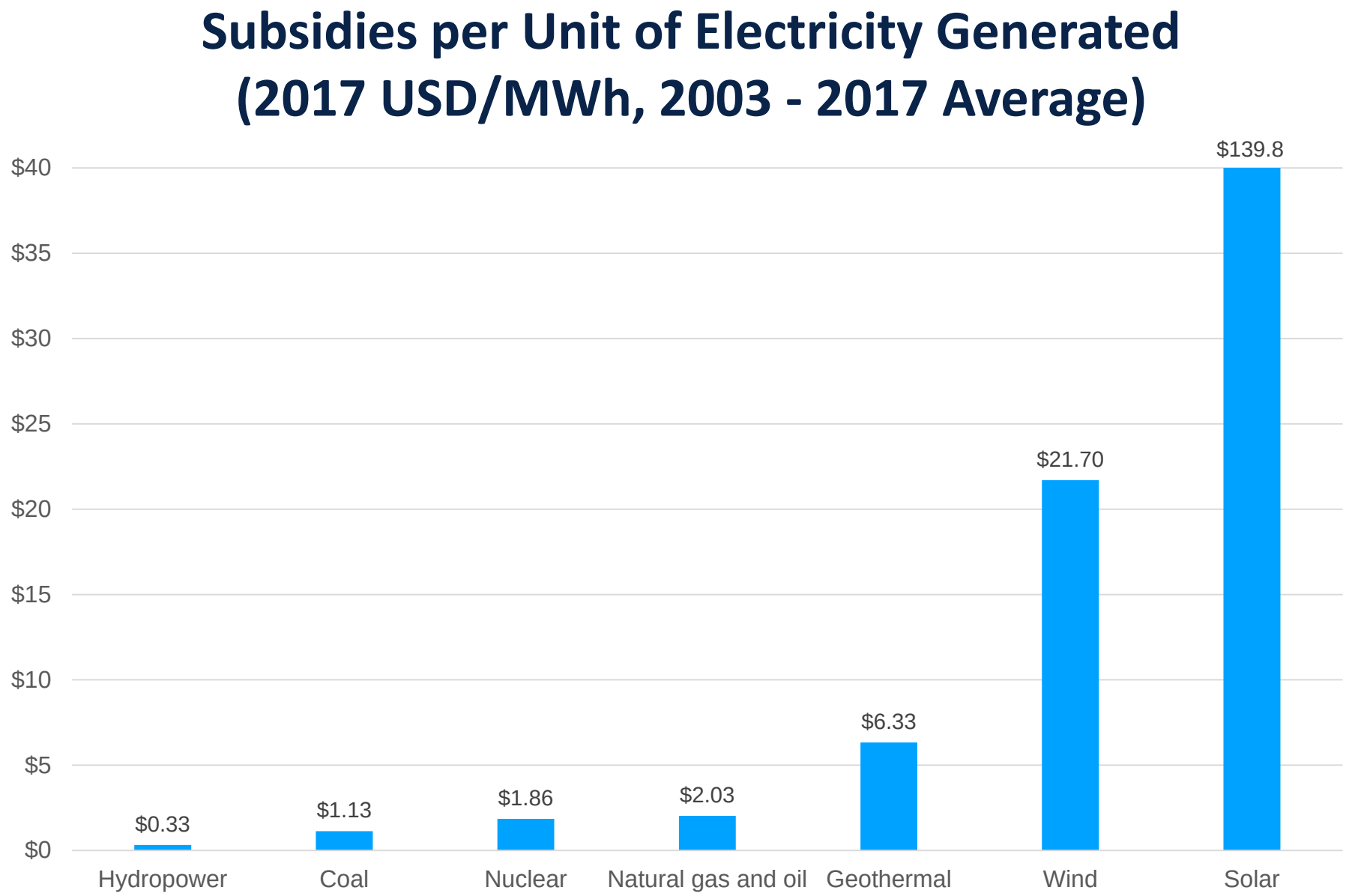
The Lack of Transparency in American Power Markets Leads to "Grid Parity" Claims & and "100% Renewable" Mandates that Mislead Ratepayers & Endanger Grid Resilience.

Comparing the ROI of Federal Energy "Subsidies"

Many claim that all forms of energy receive "subsidies," but wind & solar deliver far less return on investment (ROI).

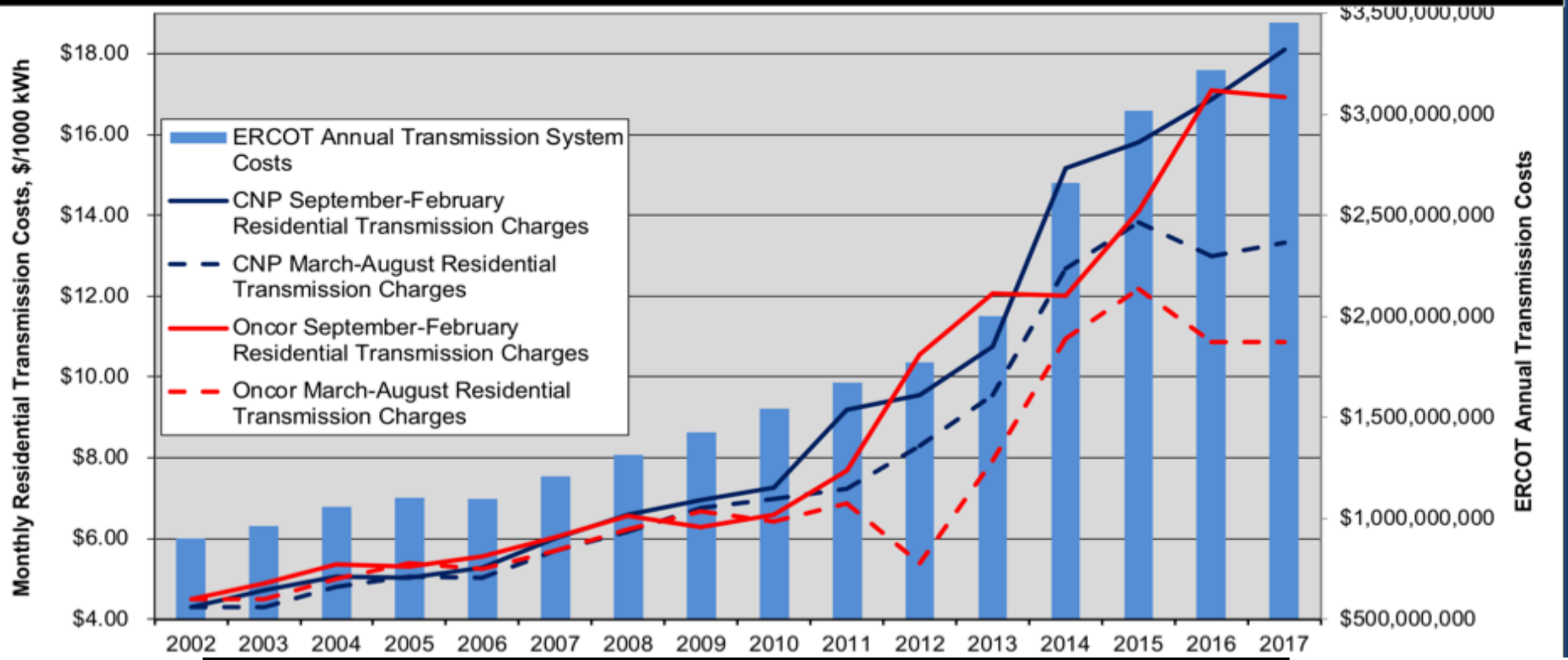
Production tax credit subsidies for existing renewable energy technologies do not promote innovation.

Sources: Office of Management and Budget, Analytical Perspectives; Joint Committee on Taxation, Estimates of Federal Tax Expenditures; Department of Energy, Statistical Tables by Appropriation; Census Bureau, Consolidated Federal Funds Report; Department of the Treasury, Section 1603 List of Awards; Energy Information Administration, Electricity Data Browser



Transmission Costs of Integrating Renewables

Case Study: ERCOT



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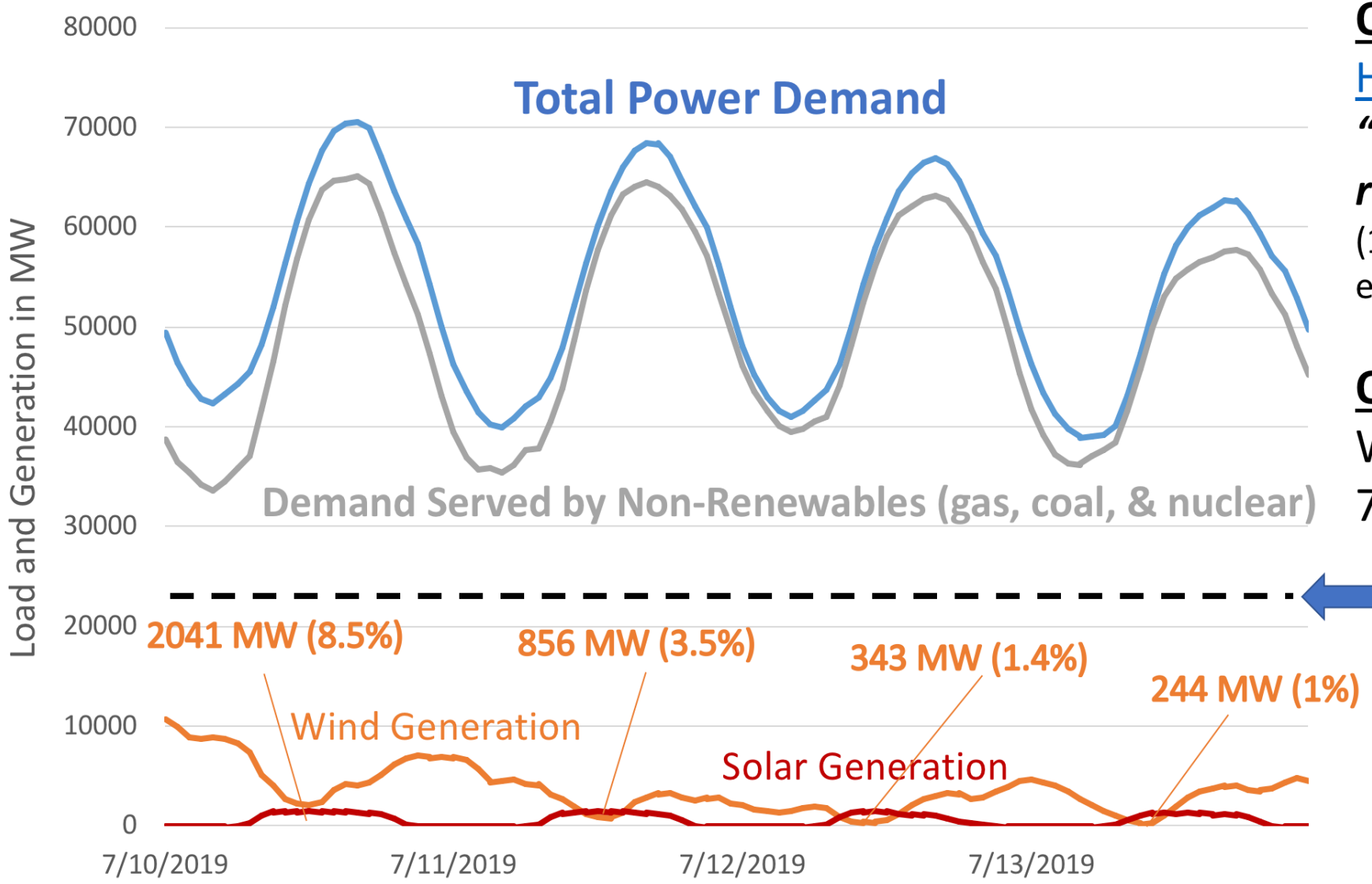
Off-Peak Exuberance vs. On-Peak Reality:



OFF-PEAK EXUBERANCE:

Houston Chronicle headline,

"Texas wind generation breaks record, ERCOT reports"

(19,168 MW Wind on 12/14/18 when entire grid needed only 36,760)

ON-PEAK REALITY:

Wind underperformance from 7/10-7/13/19 on & off peak.

Installed Wind:

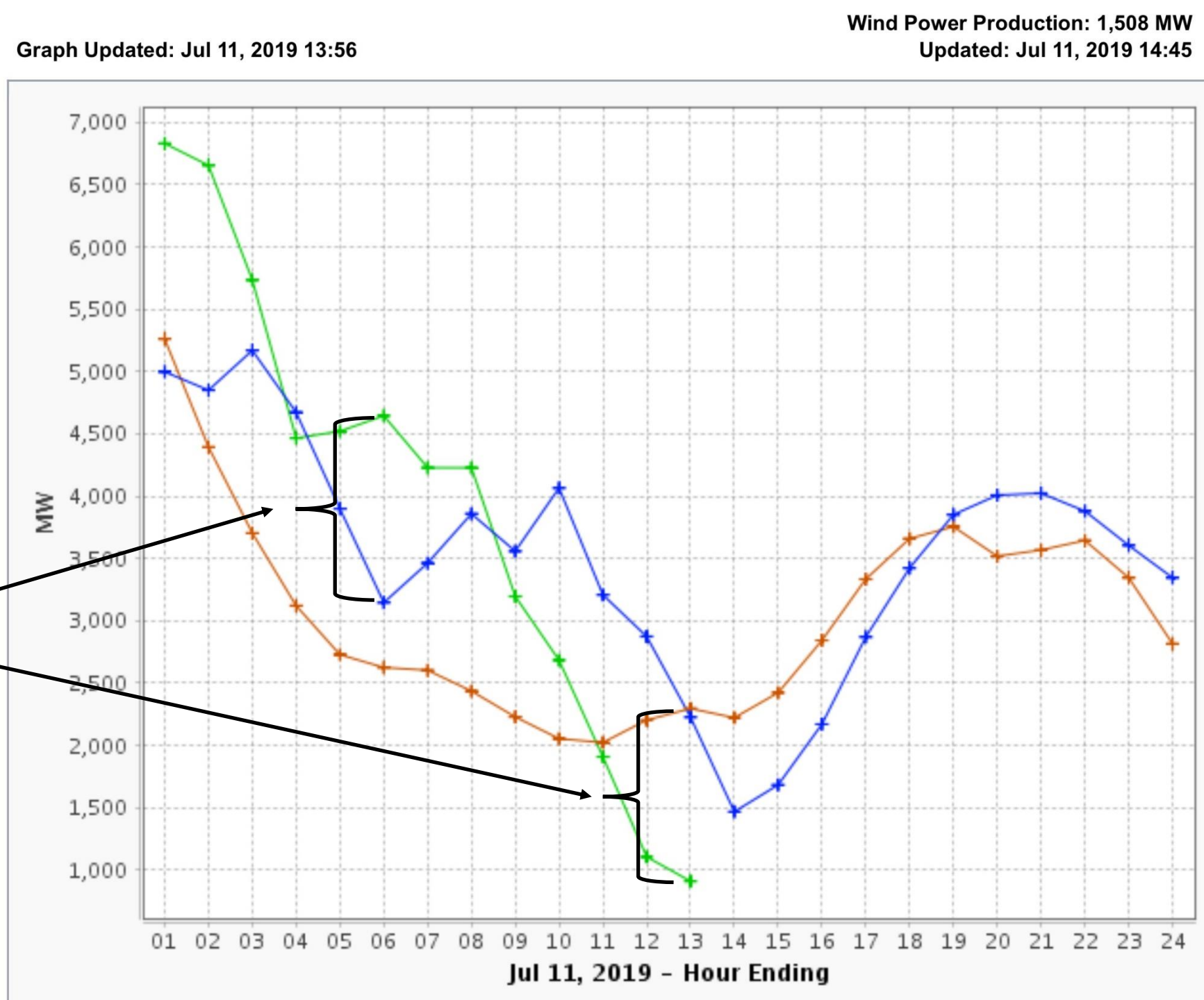
~24,000 MW

Average from 12 to 6 PM:

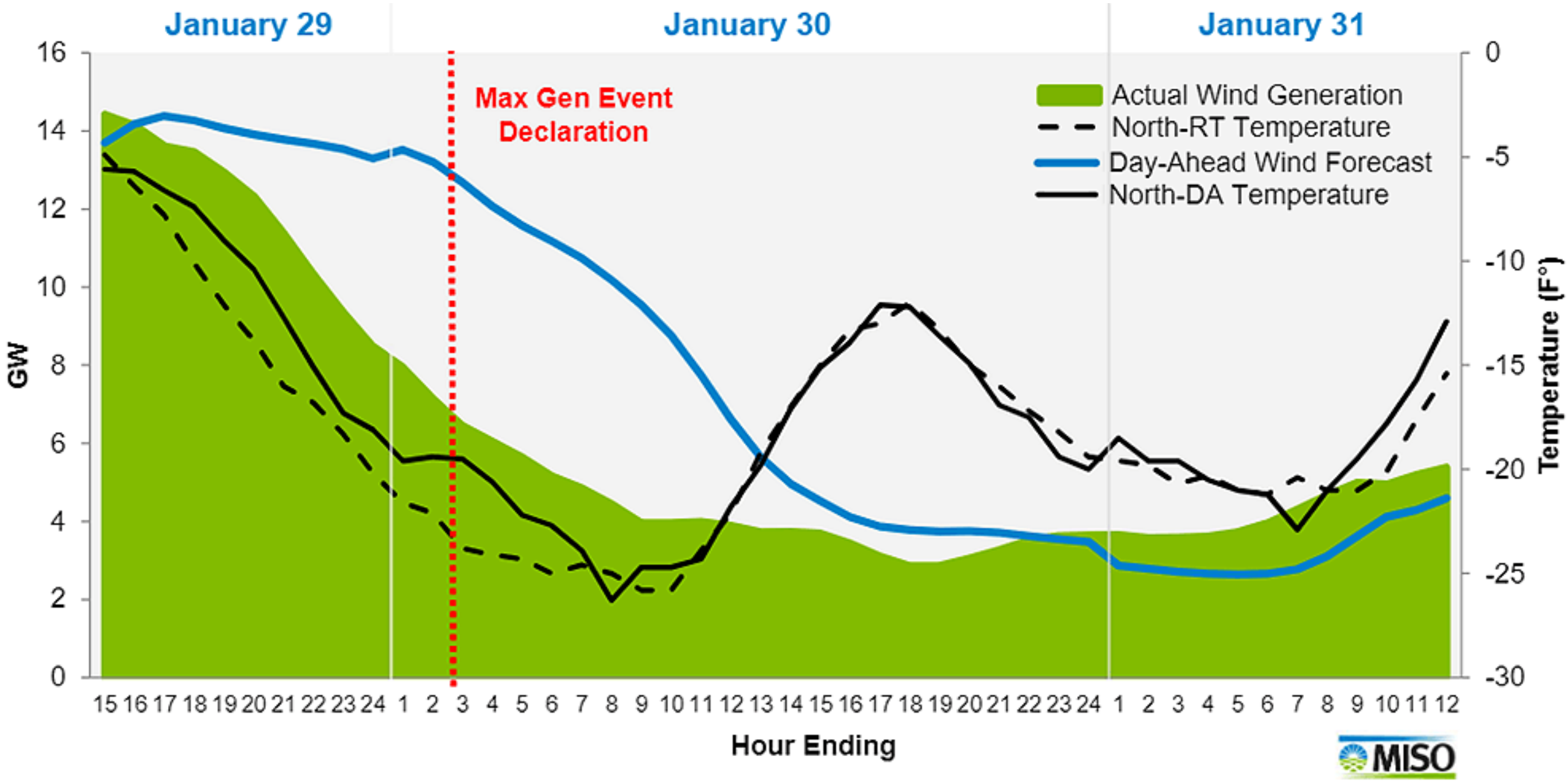
2,704 MW (11% capacity factor)

The Imputed Cost of Wind on (& off) the Grid is NOT Being Adequately Reflected in Market Designs –

Note the Forecasting vs. Actual Generation



And it's Not Just Texas in the Summer!



PJM Bomb Cyclone

Case Study in Energy Resilience

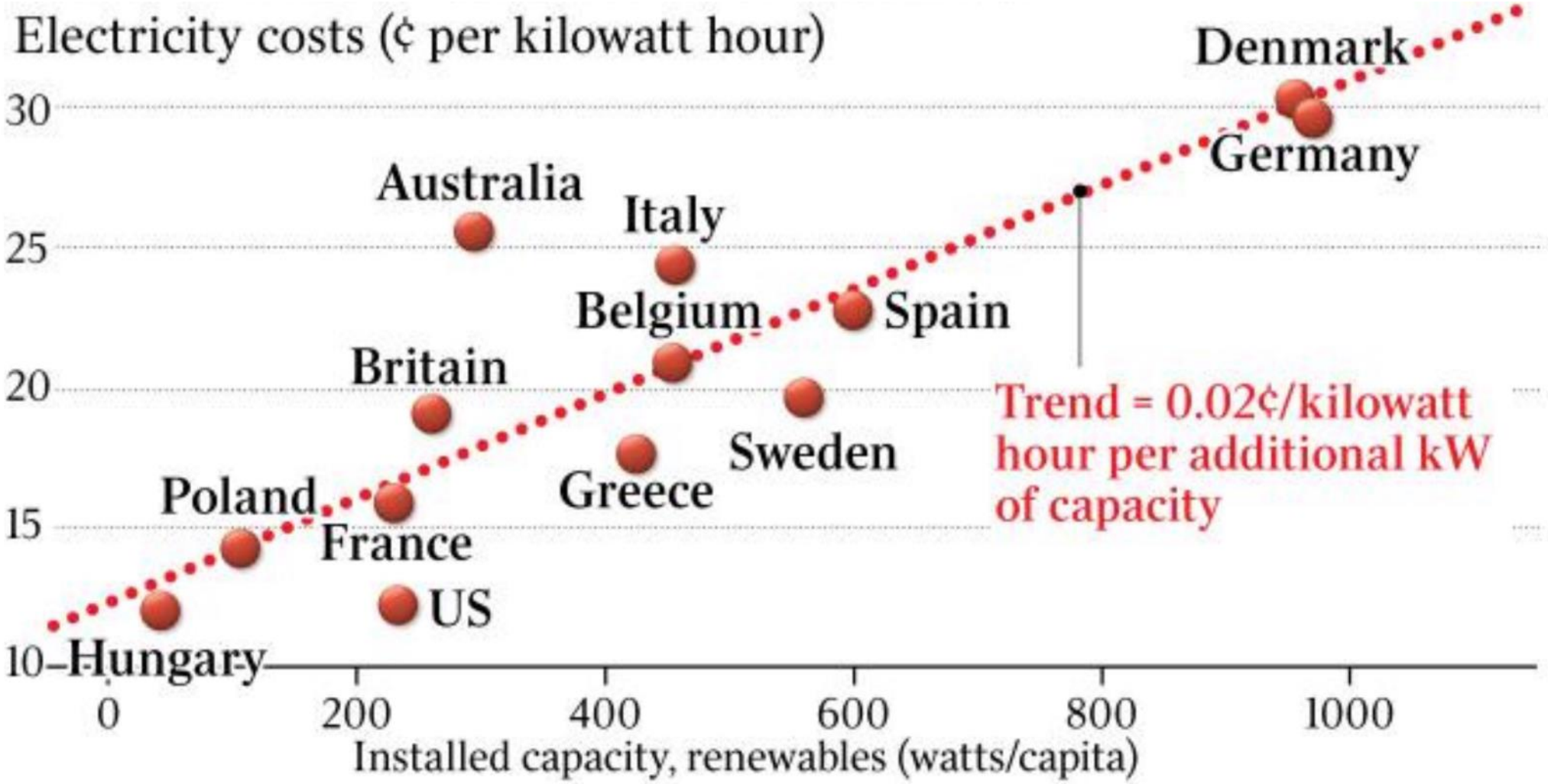
How is it Again that America is Going to Live Without Coal?

Average Daily GWh

Fuel	12/1-12/26	12/27-1/8	Positive Delta Total	Percentage Change	Share of Positive Increase
Coal	746	1,113	367	49%	73%
Gas	607	619	12	2%	2%
Renewables	127	122	-5	-4%	-
Nuclear	846	851	5	1%	1%
Oil	6	117	112	1994%	22%
Multiple fuels	2	10	8	383%	2%
Total	**2,334**	**2,832**	**504**	**21.6%**	**100%**

Source: DOE/NETL 2018

Globally, More Renewable Energy Means More Expensive Power



Expensive Energy Hurts the Poor the Worst

Civil Rights Suit Exposes California's Regressive Green Energy Agenda

"California's climate change policies … have caused and will cause unconstitutional and unlawful disparate impacts to California's minority populations …"

"Since most of the world's energy is still produced from fossil fuels, energy consumption is still highly correlated to economic productivity and per capita incomes …"

SUPERIOR COURT OF THE STATE OF CALIFORNIA

COUNTY OF FRESNO

UNLIMITED CIVIL JURISDICTION

THE TWO HUNDRED, an unincorporated association of civil rights leaders, including LETICIA RODRIGUEZ, TERESA MURILLO, and EUGENIA PEREZ,

Plaintiffs/Petitioners,

v.

CALIFORNIA AIR RESOURCES BOARD, RICHARD COREY, in his Official Capacity, and DOES 1-50,

Respondents/Defendants.

Case No. _____

VERIFIED PETITION FOR WRIT OF MANDATE; COMPLAINT FOR DECLARATORY AND INJUNCTIVE RELIEF

[Code Civ. Proc. §§ 1085, 1094.5, 1060, 526; Gov. Code § 12955 *et seq.* (FEHA); 42 U.S.C. § 3601 *et seq.* (FHA); Cal. Const. Art. I, § 7; Art. IV, § 16; U.S. Const. Amd. 14, § 1; 42 U.S.C. § 1983; Pub. Res. Code § 12000 *et seq.* (CEQA); Gov. Code § 11346 *et seq.* (APA); H&S Code § 38500 *et seq.* (GWSA); H&S Code § 39000 *et seq.* (CCAA); Gov. Code § 65088 *et seq.* (Congestion Management Plan)]

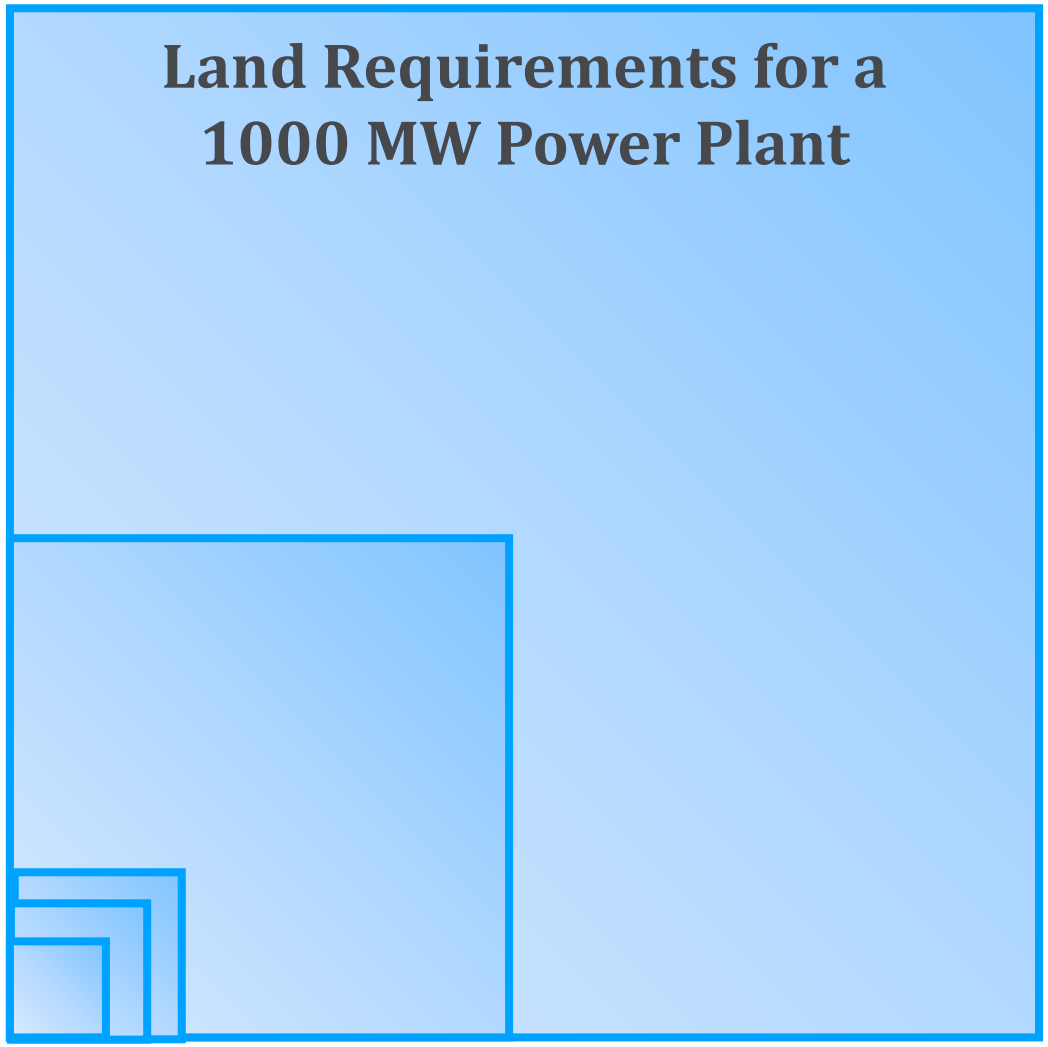
"… the "net zero" GHG threshold would operate unconstitutionally so as to disproportionately disadvantage low income minorities in need of affordable housing relative to wealthier, whiter homeowners who currently occupy the limited existing housing stock…"

"CARB's VMT reduction scheme and its ongoing efforts to intentionally increase congestion are an assault on the transportation mobility of people, which disparately harm minority workers…"

ENERGY DENSITY = ENVIRONMENTAL STEWARDSHIP

Density of U.S. Energy Resources	
Power Source	**W/m²**
Nuclear	307
Coal	182
Natural Gas	101
Crude Oil	22
Solar	8
Hydroelectric	1.7
Wind	1.0
Ethanol	0.3

Source: Vaclav Smil, *Power Density*, MIT Press, 2015.



Sources: Energy Information Administration, Today in Energy, Nov. 29, 2017; National Renewable Energy Laboratory, Land Use by System Technology; Vaclav Smil, Power Density, MIT Press, 2015.

Amount of land required for 5,000 GWh of annual production, assuming 60% capacity factor for nuclear, coal, and natural gas, 20% for solar, and 34% for wind. Land requirements for wind include spacing between turbines. Values for wind and solar do not include land for transmission lines or energy storage to ensure equal reliability to dispatchable power.

Levelized Cost of Electricity

NARUC Subcommittee on Clean Coal and Carbon Management
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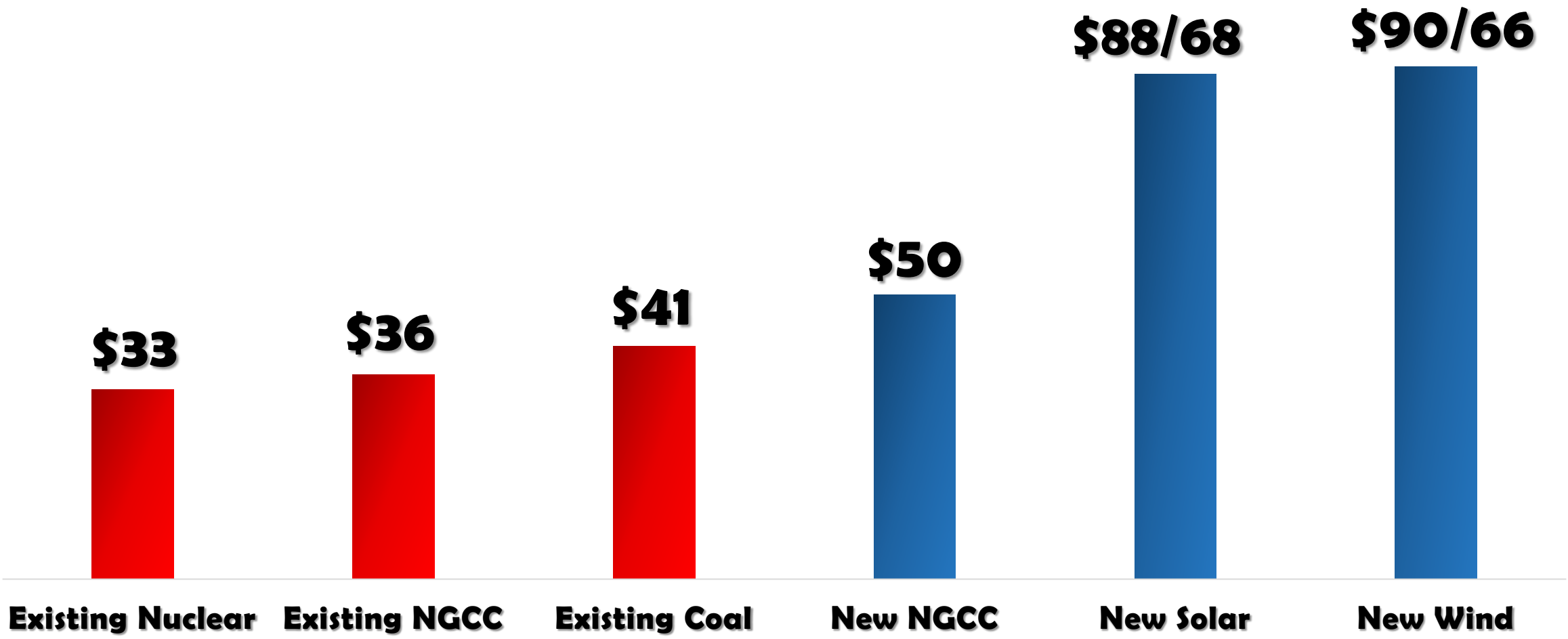
Paul Bailey, Chief Policy Officer

What does levelized cost of electricity mean?

- Typically, levelized costs are used to compare new electricity sources to one another. However, levelized costs are also useful to compare existing power plants to new sources.
- EIA: "The cost of building and operating a generating plant over an assumed financial life and duty cycle."
- Levelized costs are calculated by summing all the costs (variable and fixed O&M, capital investments, and financing costs) of an electricity source over its lifetime and then dividing those costs by the amount of electricity the source is expected to generate over its lifetime.
- LCOE is a way to compare the cost of different sources of electricity. A source with a lower levelized cost is preferable to one with a higher cost.

From "The Levelized Cost of Electricity from Existing Generation Resources." LCOE for solar and wind are shown with and without imposed costs.



Caveats

- These levelized costs represent national averages. Actual circumstances will differ for each new and existing source of electricity. However, LCOE is still a useful consideration in decision-making.
- The cost of additional transmission is not included in these LCOE estimates.
- The cost of new gas infrastructure is not included in these LCOE estimates.
- Stranded costs are not considered.

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