EPA'S CARBON PLAN: FAILURE BY DESIGN

Testimony before the Committee on Science, Space, and Technology

United States House of Representatives

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Introduction

We all want clean air to breathe and clean water to drink, and there is a growing consensus on the need to reduce our greenhouse gas (GHG) emissions, especially CO_2 emissions. However, how we approach achieving GHG reductions is critical to being able to do so and protect our economy, our global competitiveness and the very quality of our lives. The EPA's proposed rulemaking does not meet the test of relevant and impactful policy to reduce such emissions.

Whenever emission reductions are judged to be needed, some immediately turn to more regulation as a solution without honestly and objectively considering whether the necessary technology is available to achieve that regulation. If the technology is not available, passing a regulation that requires its deployment makes no sense. It can take well over twenty years to develop a technology from its laboratory cradle through commercial demonstration and many more years to achieve broad commercial deployment. Technology enables innovation and regulation and not vice versa. Once a given technology is commercially viable and available, correctly written regulation can incentivize further, incremental improvement of that technology.

So where are we today with commercially viable CO_2 capture and storage or utilization (CCS/CCUS) technology? Commercial CCS technology is still in the laboratory cradle. Today's CCS technology deployed on a coal power plant will increase the cost of the generated electricity by 80 percent (the size of the cost penalty varying with the percentage capture), with unknown overall plant reliability and availability and unknown long-term CO_2 storage liability. Worse yet, DOE has been dramatically cutting the budget for developing CCS technology, thus assuring that its commercial availability will be delayed by decades. Even the Senate Appropriations Committee in its Energy and Water Subcommittee markup for the fiscal year 2015

appropriations bill last week, cut funding for CCS and power systems by over 30 percent (from the current $392M level to $267M).

What does all of this mean? These facts are well known to EPA officials, leading an objective observer to conclude that the EPA motivation for issuing its GHG regulations was not to reduce GHG emissions, but rather to eliminate fossil fuels – first by eliminating coal use and later natural gas and other fuels – irrespective of its economic impacts on consumers (especially low income consumers). EPA will manipulate numbers and disagree that their regulations are causing severe economic impacts, but the fact is that electricity prices are rising in states that are retiring coal plants. DOE will cite the billions of dollars spent on current CCS demonstration projects (over 80 percent of those funds are from the private sector). These demonstrations are needed to demonstrate the operability of current CCS/CCUS technology. However, they are not currently operating and they will not be demonstrating the low cost CCS technology that has yet to be developed and that is necessary to meet EPA GHG regulations. EPA has essentially recognized this point by not requiring CCS on existing coal plants and imposing requirements that will result in the replacement of existing coal plants thus making their motives and strategy transparent to all.

Existing Fleet and Efficiency

EPA has proposed four "building blocks" to get to the goal of reducing carbon emissions from coal-fired power plants by 30 percent from 2005 levels by 2030. Those are: improve efficiency at each power plant by 6 percent as a fleet-wide average; employ "environmental dispatch" to run natural gas plants more and coal plants less; substitute renewable energy for coal; and reduce demand from consumers by 1.5 percent per year.

So let's talk about power plant efficiency. What does a 6 percent efficiency improvement look like? To be honest, I can't tell you, and I'm not sure anyone can really tell you, because I'm not sure it's ever been done before. The existing coal fleet average efficiency is somewhere in the 33 to 35 percent range, meaning a power plant is 33 to 35 percent efficient in converting the energy value of the raw material into actual usable energy output, or Btus. If you converted a power plant from 35 percent efficiency to 41 percent efficiency, you essentially would be looking at rebuilding the entire plant. AEP's Turk plant in Arkansas will have a 39-40 percent steam cycle efficiency, as opposed to about a 35 percent average coal-fired plant steam cycle efficiency. To get those extra 4-5 percent efficiency points, they built a plant that is entirely different from a subcritical coal plant.

The National Coal Council's (NCC) most recent report, issued just two months ago, specifically looked at possible power plant efficiency improvements. The NCC stated that its report "does not provide a quantitative assessment of the degree to which these existing technologies could improve the heat rate (or efficiency) of the existing coal fleet," but there are other credible sources to show what is feasible for existing coal plants.[1] For example, an International Energy Agency paper from the fall of 2013 noted that "Retrofits will increase efficiency significantly, by up to as much as 2–3 percentage points, and may compensate completely for loss of performance from addition of environmental control equipment after a plant was first commissioned."[2] Two to three percent. That's half to one-third of EPA's six percent.

[1] See the Reliable & Resilient: The Value of Our Existing Coal Fleet the National Coal Council's May 2013 report at http://www.nationalcoalcouncil.org/NEWS/NCCValueExistingCoalFleet.pdf

[2] International Energy Agency, Upgrading and efficiency improvement in coal-fired power plants, No. 13/9, August 2013, http://www.iea-coal.org.uk/documents/83185/8784/Upgrading-and-efficiency-improvement-in-coal-fired-power-plants,-CCC/221.

The NCC's report does list a number of changes that could be made at a power plant to improve efficiency. It is useful to simply insert here the findings of that expert group on power plant efficiency improvements, as summarized in the report's executive summary:

> "[C]oal could potentially be dried using waste heat, making the boiler more efficient. Steam turbines could potentially be refit with modern and more efficient multistage rotors. In addition, corrosion and deposition on major heat transfer components (boiler tubes and condensers) could potentially be reduced, making heat transfer in those components more efficient.
>
> "On some units, alkali materials can be injected into flue gases to reduce acidity that would otherwise present corrosion problems at low temperatures, thereby potentially allowing greater heat recovery from flue gases. Improved sensors and controls could potentially allow a plant to operate closer to conditions optimal for higher efficiency. Variable speed drives could potentially be used to make motors more efficient, particularly at lower load.
>
> "While many of the needed technologies already exist and are operating on some units, these are not a one-size-fits-all package of solutions that can be readily applied to or accommodated by the existing coal fleet. The opportunity to apply these efficiency improvements across the existing fleet will vary significantly.
>
> "In some cases, the opportunity will be negligible because the unit either is already operating in a highly efficient mode with some or all of the improvements in place or because the implementation of potential improvements is not cost-effective and/or technically feasible. As such, the degree of efficiency improvement possible at a given unit is highly site-specific, and may depend on the design of the unit, current maintenance

procedures, whether the unit operates as base load or cycling, the type of coal used by the unit, system economics and the economics of the specific measure and the configuration of the unit. Even the location of a unit is relevant to efficiency because plant efficiency is sensitive to ambient temperature and atmospheric pressure (elevation)."[3]

Congress recognized in the Energy Policy Act of 2005 that getting even 4 percent efficiency improvement was so costly that it established a massive tax credit as an incentive. Section 1307 of the EPACT provides $1.3 billion in tax credits to "advanced coal-based generation technology" projects, which for existing units are defined to include projects on units that "achieve[] a minimum efficiency of 35 percent and an overall thermal design efficiency improvement, compared to the efficiency of the unit as operated, of not less than –

- 7 percentage points for coal of more than 9,000 Btu
- 6 percentage points for coal of 7,000 to 9,000 Btu, or
- 4 percentage points for coal of less than 7,000 Btu"[4]

By the way, that's a "design" efficiency improvement, which recognizes that the plant ultimately may get less thermal efficiency improvement in operation.

The bottom line is that Congress knew this was "rebuild the power plant" levels of efficiency improvements, hence the tax credit. EPA, of course, argues that the proposed rule provides "flexibility," and that not everyone will have to do this everywhere. Yet its final GHG reduction level is based on 6 percent efficiency improvement being the industry-wide average (i.e., because it has baked 6 percent industry-wide efficiency improvement into the 30 percent below 2005 level target).

[3] See the pg. 4-5 of Reliable & Resilient: The Value of Our Existing Coal Fleet the National Coal Council's May 2013 report at http://www.nationalcoalcouncil.org/NEWS/NCCValueExistingCoalFleet.pdf
[4] See P.L. 109-58 Section 1307 at http://www.gpo.gov/fdsys/pkg/PLAW-109publ58/html/PLAW-109publ58.htm

Finally, it is important to note that there are legal barriers to doing power plant efficiency improvements, and EPA knows it well. Specifically, significant changes to an existing power plant trigger a provision of the Clean Air Act known as "New Source Review" or NSR. Essentially, under this statutory provision, existing industrial facilities are treated like new facilities for the purposes of clean air permitting when "major modifications" are made, meaning they become subject to more stringent air limits that can be very expensive to meet. EPA had discretion in determining what is a major modification, and power plants and other industrial facilities sensibly do all they can to avoid triggering the requirements and their subsequent expenses. In the case of CO2 emissions, EPA surely must know it is creating a catch-22: big efficiency improvements will trigger NSR, which will require the installation of equipment to reduce other emissions and decrease efficiency. Again, the NCC's report summarizes the issue well: "In general, if a plant owner expects that an efficiency improvement would lead to [NSR] designation, the efficiency project will not be pursued as the resulting permitting process would be extensive and the compliance requirements would be onerous and likely too stringent to be practicable. Unfortunately, this prospect has all but eliminated RD&D that would more than marginally innovate the fleet."[5]

Current Situation (Failure by Design)

On June 25, 2013, President Obama issued his Presidential Memorandum – Power Sector Carbon Pollution Standards. In this memorandum to EPA, he directed the agency, by September 30, 2013, to issue a new proposed rule to establish New Source Performance Standards (NSPS) for CO_2 emissions from fossil fueled power plants, replacing the rule EPA proposed for that

[5] See the pg. 5 of Reliable & Resilient: The Value of Our Existing Coal Fleet the National Coal Council's May 2013 report at http://www.nationalcoalcouncil.org/NEWS/NCCValueExistingCoalFleet.pdf

sector on April 13, 2012. He also directed EPA to propose standards or guidelines governing emissions from existing power plants by June 1, 2014.

The most constructive thing that can be said about the resulting proposed regulations is that EPA almost met the President's schedule. They published the first rule on their website on September 20, although it did not appear in its final form in the Federal Register until January 8, 2014. The existing source rule was released on EPA's website on June 2, and the formal version was printed in the Federal Register on June 18. That's the good news.

The bad news is that these proposals follow such a tortured logic that there is a reasonable likelihood that a reviewing court will, perhaps three of four years from now, determine that EPA's legal and technical arguments lack merit and the agency must start over again.

My background is in technology and I would like to offer you my views on why I believe that EPA's two proposed power plant rules are harmful to technology development, and, because of that, will probably have the perverse effect of increasing CO_2 emissions, regardless of whether they withstand litigation or are reversed.

First, let us review the fundamental legal criterion for both the Section 111(b) NSPS rule and the Section 111(d) existing source performance standards rule: the Clean Air Act's definition of a "standard of performance." "The term 'standard of performance' means a standard for emissions of air pollutants which reflects the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated." The key phrase here is "best system of emission reduction which … has been

adequately demonstrated." These are the brutal facts regarding the technology we are all focused upon, CCS:

- The technology is not "adequately demonstrated." In fact, it has not been demonstrated at all in the sense Congress intended in the Clean Air Act. There is no commercial scale CCS system operating on a power plant (coal, gas, or oil-fired) anywhere on the planet. That is a fact.
- At least two major power plant vendors have provided official statements that CCS technology is not ready for commercial deployment. The first, Bob Hilton, VP at Alstom Power, offered his view before this Committee at a hearing on March 12, 2014. "Alstom does not currently deem its technologies for Carbon Capture commercial and, to my knowledge, there are no other technology suppliers globally that can meet this criteria or are willing to make a normal commercial contract for CCS at commercial scale." [6] The second view was offered by B&W in that company's formal comments on EPA's proposed NSPS rule. "As a developer and supplier of C02 capture technologies, we do not agree that these technologies are ready for commercial deployment on new EGUs today to meet this emission limit." [7] These statements from two companies at the forefront of CCS and power technology are tantamount to facts.
- Multiple reports and technical studies by the Department of Energy have concluded that adding CCS to a traditional coal-fired power plant will increase the cost of electricity from that unit by about 80 percent. This is an unacceptable cost increase and is one of the primary reasons that DOE spends about $400 million a year to improve CCS technology. These are facts.

[1] Testimony by Robert Hilton before the US House of Representatives Subcommittee on Environment and Subcommittee on Energy, of the Committee on Science, Space, and Technology, March 12, 2014.
[7] B&W, Comment available on the EPA regulatory docket, document # EPA-HQ-OAR-2013-0495-8348.

- Although we are conducting research in carbon storage, we have relatively little experience with injection of large quantities of CO_2 into geologic formations – none at the 3-4 million TPY rate typical for a large coal-fueled power plant. EPA regulations intended to protect groundwater supplies require CO_2 storage facilities to monitor the underground CO_2 plume for 50 years after CO_2 injection has ceased to ensure that nothing goes wrong. These are facts.
- The other option for storage of CO_2 is Enhanced Oil Recovery (EOR), which provides the economic bonus of enabling production of high value crude oil. However, EPA's proposed NSPS included provisions making EOR activities impractical, at least in the view of one major EOR producer. A white paper[8] on the reporting requirements of the rule by Denbury stated, "the proposed NSPS rule will ***foreclose – not encourage*** – the use of CO_2 captured by emission sources in EOR operations." [emphasis in original] EPA's requirements convert a resource recovery operation into a waste disposal operation, which is incompatible with EOR activities. EOR is a dynamic process that involves "a host of changes to the originally-approved plan." EPA's proposed monitoring, reporting, and verification requirements would necessitate re-permitting the operation after every change and expose the project to time consuming permit challenges and litigation. More unpleasant facts.

Against these facts, let us review EPA's views on CCS technology:

[8] Subpart RR Flaws Preclude EPA's Reliance on CO2-EOR in the Proposed NSPS Rule, Denbury, (undated).

- "[W]e are not proposing that CCS does or does not qualify as the ''best system of emission reduction'' that ''has been adequately demonstrated'' for new coal-fired power plants."[9]
- "EPA believes that partial CCS should be considered BSER."[10]
- "The EPA believes the cost of 'full capture' CCS without EOR is outside the range of costs that companies are considering for comparable generation and therefore should not be considered BSER …."[11]
- "[T]he EPA is not proposing and does not expect to finalize CCS as a component of the BSER for existing EGUs in this rulemaking."[12]

These are EPA's views from regulatory proposals for new and existing power plants made public in 2012, 2013 and 2014, seemingly (and in some cases actually) conflicting with one another, without any significant change in during that period in the readiness of the technology.

I believe in technology solutions to technical problems like pollution. There is a strong track record of government and the private sector collaborating to develop technologies like flue gas desulfurization, selective catalytic reduction, and mercury capture systems – when provided adequate federal resources and time. Past NSPS rules for SO2 and NOx emissions did this: they based a regulation on proven, monitored application of a technology on many commercial scale units. I believe that with adequate time and resources, CCS can make a major contribution to the effort to address global climate change. However, the Administration in its proposed CO_2 NSPS

[9] USEPA, preamble to 2012 proposed power plant NSPS. 77FR22411, April 13, 2012.
[10] USEPA, preamble to 2014 proposed power plant NSPS. 78FR1479.
[11] Ibid., p.1435.
[12] USEPA, preamble to 2014 proposed rule for existing power plants, 79FR34857, June 18, 2014.

can point to no commercial operating units with CCS, and the Administration is proposing again to reduce funding for coal and CCS research.

This is not just about coal, or CCS, or electric utilities. The existing coal fleet provides about 40 percent of our electricity and does so at about half the cost of any technology that would replace those existing units. The U.S. enjoys electricity priced at about one-half to one-third that of most of Europe. This means more money in the pockets of American consumers, and a competitive edge for U.S. manufacturing in international markets. It would be more than a shame to throw away those enormous economic benefits by reaching beyond our grasp on these two proposed regulations. But we are headed in that direction. (See Appendix B for a compelling presentation of the effect EPA's rulemaking will have on my home state of Texas.) We are already on a path to retire about 20 percent of our existing coal units by 2018, even though many of those units were essential to getting us through last winter's cold waves. And these proposed rules promise to stop any new coal units, while forcing another 20 percent to retire, at least according to EPA. A close study of EPA's technical support documents certainly supports concerns that the system impacts could be much worse.

It is bad enough that EPA's rules will put our nation's electric reliability at risk and significantly increase electricity rates. As somebody who has spent his professional life trying to advance technology, a pill that is almost as bitter to swallow is the fact that EPA has failed to propose a *technology* rule when the problem the President has announced he wants to address will **demand** a *technology* solution.

The President and Administrator McCarthy have said that the problem of global climate change will demand "leadership" from the United States. For years, we were heading down that path by fully funding DOE's public-private partnerships to incubate CCUS so that, one day, the

world's coal fleet would have a technology solution capable of making meaningful progress toward that goal. Yet, now, by simultaneously underfunding CCUS research and implementing regulatory mandates that will hinder, not further, CCUS development, we are not just failing to "lead," we are undermining the world's ability to develop the one technology that has a prayer of addressing the problem.

Technology has benefits to the environment and the economy that don't need to be cut off by EPA rulemaking. We know that the opportunity is out there for CCS, or more accurately CCUS. In the U.S., we have two major projects being undertaken by the private sector to capture carbon from a power plant and use the CO_2 for enhanced oil recovery. One is Southern Company's Kemper County facility in Mississippi, a new facility nearing completion at which the company will gasify lignite, produce a syngas that will be combusted to generate electricity, produce several byproducts like fertilizer and industrial chemicals, and produce a clean CO_2 stream, which will be sold to oilfield companies for enhanced oil recovery. The other is NRG's project at the existing W.R. Parish plant, a post-combustion capture project where the CO_2 again will be used for enhanced oil recovery. This is the kind of technological leadership that needs to be encouraged, not precluded as a consequence – intended or unintended – of environmental policy.

Conclusions

There are four fundamental flaws in the EPA's approach to the three rules proposed and they are the following:

1. Meaningful policy must be both relevant and impactful. DOE has the ability to provide such analysis. Why is it not referenced and included? Interagency collaboration is

anticipated and required. Where is it? From a purely scientific standpoint, the implications of these rules are that:

- They address 0.18% of global CO_2 emissions
- Climate science would equate that to 0.01 degree Celsius of global warming impact
- Resulting impact to sea level is the thickness on four sheets of paper or 1/3 the thickness of a dime
- This rulemaking does not meet the test of meaningful GHG policy

2. Technology capabilities and assumptions made by EPA in unit and system performance are not founded on science and engineering. Notwithstanding the fact that U.S. coal-fired power plants and natural gas-fired facilities are the most efficient in the world, the targets set are clearly beyond achievable targets – especially in a global setting.

3. EPA appears to have approached the challenge with a politically driven end game in mind and worked in reverse to make necessary assumptions to meet targets, including:

    - Availability of the necessary infrastructure to enable switching to natural gas from coal.
    - Availability of the system and transmission infrastructure to enable renewable and gas replacement of coal.
    - Assuming natural gas plant utilization factors unrealistically high.

- Assuming technology insertion when technologies are unproven and not commercially available. I testified nearly a year ago on the absurdity of that assumption that was based on plants not yet build or operational.

4. Environmental policy cannot be developed in a vacuum with energy affordability and security not considered. System reliability will be impacted negatively and analyzing "reserve adequacy" is an incomplete approach that is dangerous to our energy security. Affordability is never mentioned in any manner and estimates range from a low side of two-times to a high side of four-times the average cost to the customer in states most impacted. More troubling in both of the areas is that there is no body of work addressing these issues. Why?

It is all pain for no gain. We need technology to address existing coal and natural gas facilities as the world will double over the next 50 years and in 2060 global energy will still be >80% supplied by coal and natural gas. Forcing this rule on the U.S. will:

- Hobble U.S. competitiveness in the global marketplace.
- Not impact the climate in any meaningful way through rulings on CO_2.
- Not provide technology leadership the rest of the world can follow
- Assure the failure of CCS/CCUS by cutting funding for the development of low cost CCS/CCUS technology

Most importantly, we may be declaring victory against GHG emissions and climate change by majoring on the minor. We are not looking at comprehensive solutions, we cannot achieve environmental or economic success through focusing just on CO_2 for coal-fired power plants.

APPENDIX A

Turbine Upgrade or Efficiency Improvement Projects Cited in NSR Enforcement Initiative

This list is limited to turbine upgrades or replacements – the list would be much longer if improved materials of construction and improved designs of heat transfer surfaces were included.

1. **Turbine Upgrade or Efficiency Improvement Projects Cited in NSR Enforcement Initiative**

- *United States v. Duke Energy Corp.*, No. 00-cv-01262 (M.D.N.C. Dec. 22, 2000) (GE Dense Pack turbine upgrades at Belews Creek Units 1 and 2 and Marshall Unit 3);
- *New York v. Niagara Mohawk Power*, No. 02-CV-24, Compl. (W.D.N.Y. Jan. 10, 2002), ¶ 202 ("upgraded the turbine" on Huntley Unit 63 in 1987), ¶ 323 ("replaced the turbine" on Huntley Unit 67 in 1991);
- *United States v. East Kentucky Coop.*, No. 04-34-KSF, Compl. (E.D. Ky. Jan. 28, 2004), ¶ 60 ("replacement or renovation ... of major components of the ... turbine at the unit" on Dale 4 in 1995-1995), ¶ 76 ("replacements or renovations of major components of the ... turbine" on Dale 3 in 1996);
- *Sierra Club v. Portland General Electric*, No. 08-cv-01136, Am. Compl. (D. Or. Nov. 29, 2010), ¶ 134 ("a plant turbine upgrade" at Boardman in 2003);
- *United States v. Ameren Missouri*, No. 4:11-cv-77, Am. Compl. (E.D. Miss. June 28, 2011), ¶ 67 ("associated turbine replacements" at Rush Island Unit 1 in 2001-2002), ¶ 73 ("associated turbine replacements" at Rush Island Unit 2 in 2003-2004);
- *Conservation Law Foundation, Inc. v. Public Service of New Hampshire*, No. 11-cv-00353, Compl. (D.N.H. July 21, 2011), ¶ 49 ("removed a high pressure/intermediate pressure turbine, and replaced it with a new HP/IP turbine" at Merrimack Unit 2 in 2008);
- *Dine Citizens Against Ruining Our Environment v. Arizona Public Service Company*, No. 1:11-cv-889, Am. Compl. (D.N.M. Jan. 6, 2012), ¶ 48 ("replacement of the high pressure turbines" at Four Corners Units 4 and 5 in 2007), *id.* ("Plaintiffs are informed and believe ... that these high-pressure turbine upgrades increased the design-level heat input rate of each of these units, thereby increasing each unit's generating capacity and its potential to emit air pollution.");
- *United States v. Dairyland Power Coop.*, No. 12-cv-462, Compl. (W.D. Wisc. June 28, 2012), ¶ 38 ("upgrading of the turbine at the J.P Madgett Unit in 2004");
- *Sierra Club v. PPL Montana LLC*, No. 1:13-cv-32, Am. Compl. (D. Mont. Sept. 27, 2013), ¶ 55 ("Replacement of the Low Pressure Turbine" on Unit 3 in 2011), ¶ 57 ("High Pressure/Intermediate Pressure Turbine Replacement" at Unit 2 in 2008), ¶ 58 ("High Pressure Turbine Replacement" at Unit 3 in 2007), ¶ 59 ("High Pressure Turbine Replacement" at Unit 4 in 2006), ¶ 60 ("Replacement of the High Pressure and Intermediate Pressure Turbines" at Unit 1 in 2006).

2. **Standard Turbine Overhauls or other Turbine Projects Cited in NSR Enforcement Initiative**

- *United States v. Cinergy*, No. IP99-1693, Third Am. Compl., (S.D. Ind. June 29, 2006) at ¶ 172 (replacement of "turbine blades" on Beckjord Unit 6 in 1994);
- *United States v. Duke Energy Corp.*, No. 00-cv-01262, Compl. (M.D.N.C. Dec. 22, 2000), ¶ 32 ("turbine overhaul" at Allen Unit 5 in 2000), ¶ 60 ("turbine overhaul" at Allen Unit 4 in 1998), ¶ 195 ("turbine rehabilitation" at Cliffside Unit 4 in 1990);
- *Sierra Club v. Dayton Power & Light, Inc.*, No. C2-04-905, Compl. (S.D. Ohio Sept. 21, 2004), ¶ 43 ("overhaul of the turbine" on Stuart Unit 1 in 1980);
- *United States v. American Electric Power*, No. C2-05-360, Compl. (S.D. Ohio Apr. 8, 2005), ¶ 97 ("replacement of the low pressure turbine rotor" on Conesville Unit 5 in 1997), *id.* ("replacement of the low pressure turbine rotor" on Conesville Unit 6 in 1997);
- *Sierra Club v. PPL Montana LLC*, No. 1:13-cv-32, Am. Compl. (D. Mont. Sept. 27, 2013), ¶¶ 53 ("Low Pressure Turbine Overhaul" at Unit 1 in 2012), *id.* ("Turbine/Generator Base Overhaul" at Unit 1 in 2012), ¶ 54 ("Turbine Generator Base Overhaul" on Unit 2 in 2011), ¶ 55 ("Turbine Generator Base Overhaul" on Unit 3 in 2011), ¶ 55 ("Intermediate Pressure Turbine Overhaul" on Unit 3 in 2011), *id.* ("Turbine/Generator Base Overhaul" on Unit 3 in 2011), ¶ 56 ("LP1 & LP2 Turbine Rebuild" at Unit 4 in 2009), *id.* ("Low Pressure Turbine" at Unit 4 in 2009), *id.* ("Turbine/Generator Base Overhaul" at Unit 2 in 2008), *id.* ("Low Pressure Turbine Overhaul" at Unit 2 in 2008), ¶ 59 ("Intermediate Pressure Turbine Overhaul" at Unit 4 in 2006).

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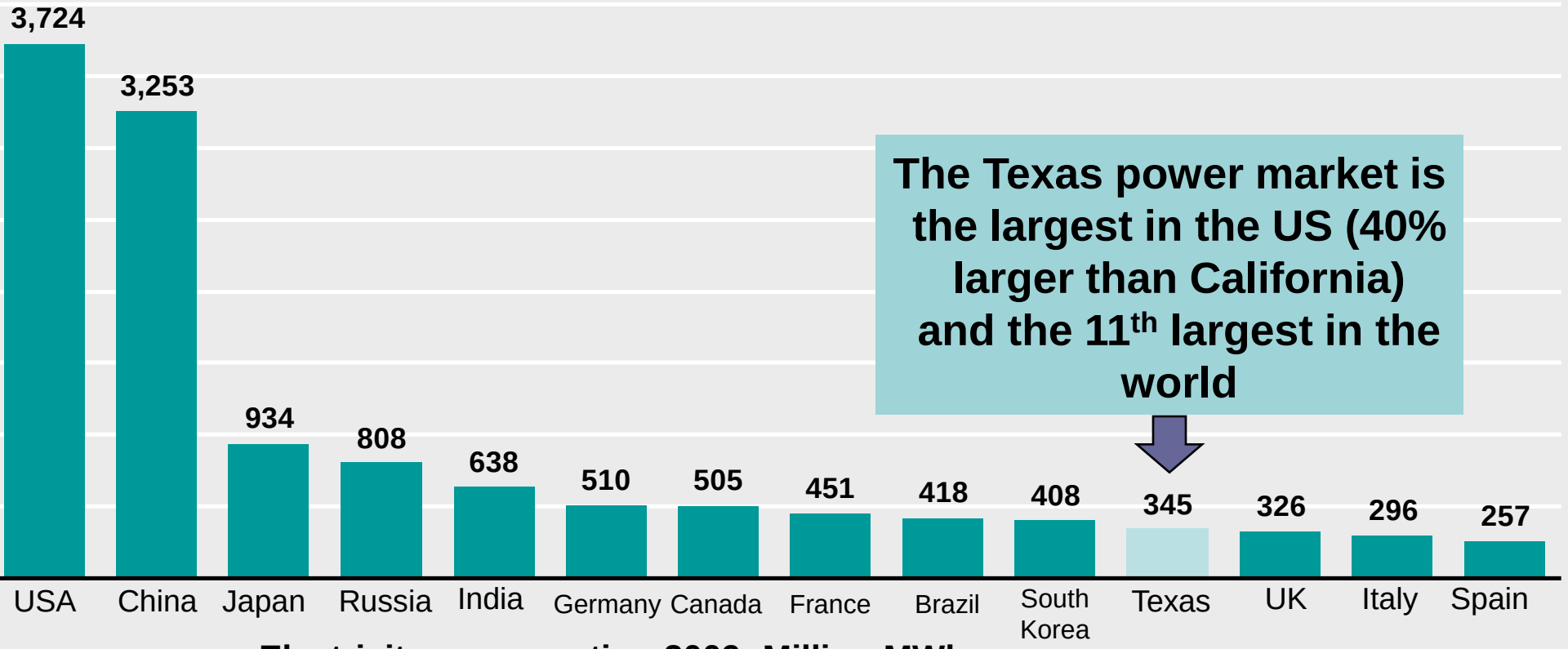
An Assessment of the Impact of EPA's 111(d) Rule (a.k.a. "Clean Power Plan") on Texas

July 7, 2014

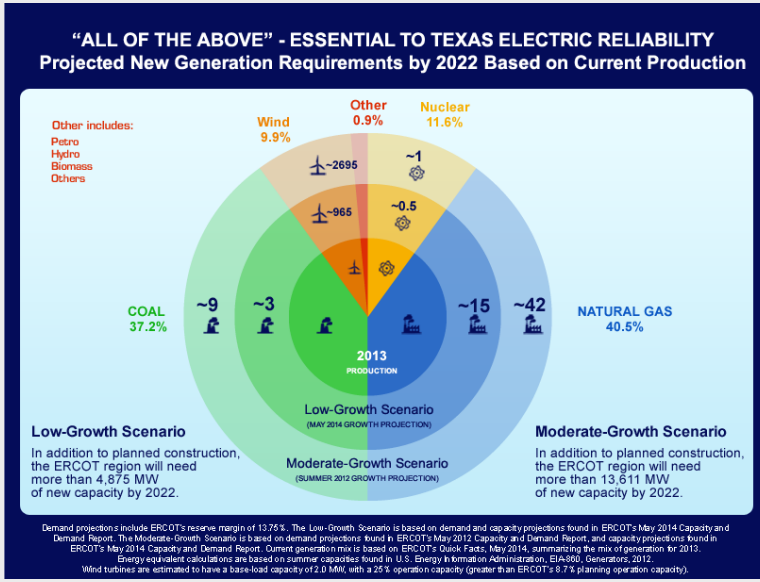
Population, Industry, & Climate Make the Texas Power Market. . .

"Like a Whole Other Country"



NO MEGAWATTS TO SPARE: Texas Uses a Diverse Range of Fuels, Including Coal, to Keep Reliability Up & Cost Down

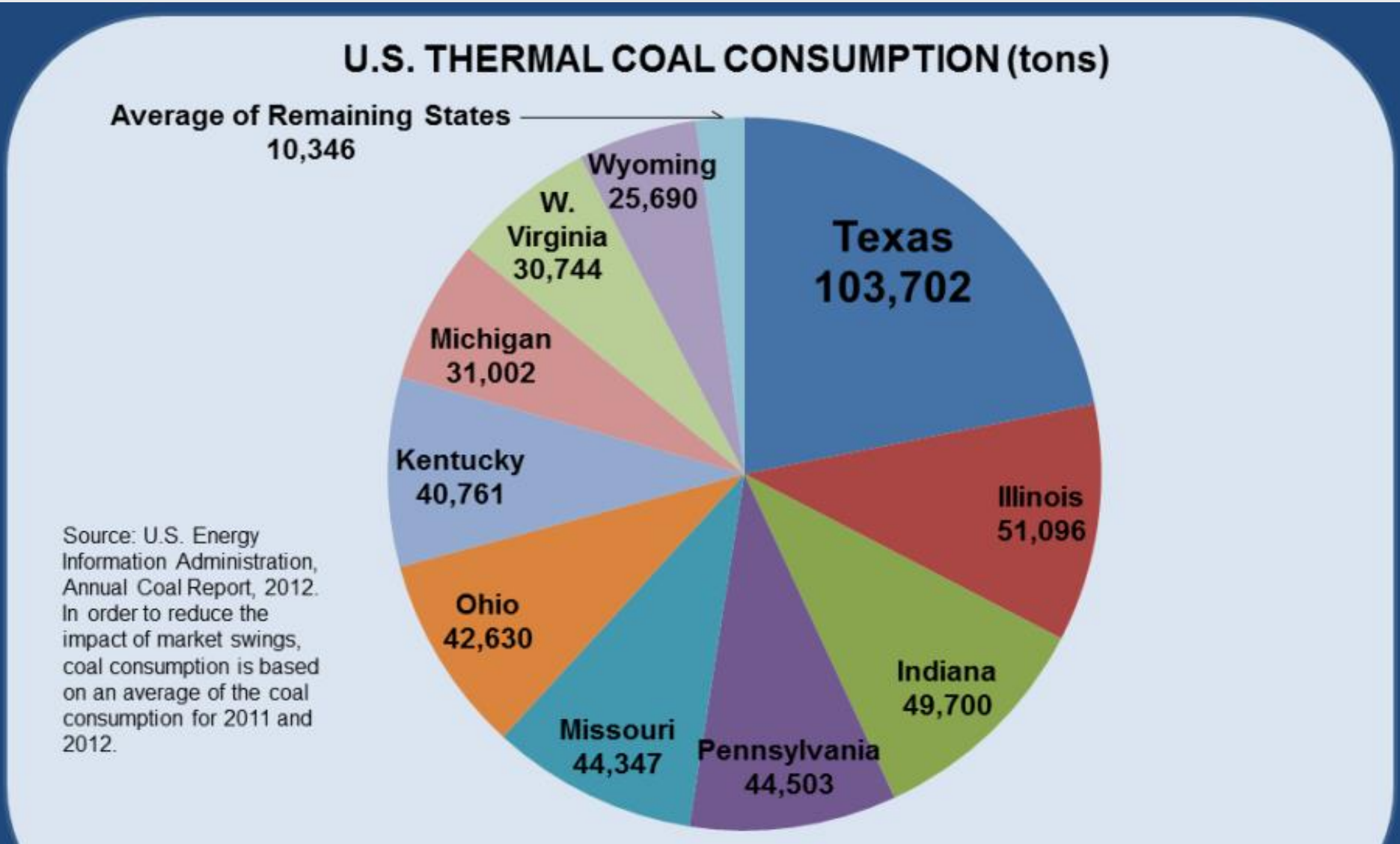
- Texas uses more energy than any other state in the nation, almost as much as the next two states combined (California and Florida).
- *Nearly half of Texas*' electricity use is for industry and manufacturing, which includes the oil & gas and petrochemical industries (more than next 3 states combined).



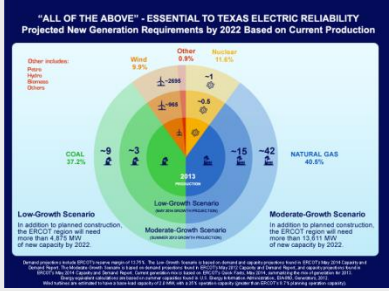
- To keep costs down and production up,Texas uses coal to maintain fuel diversity – accounts for 37-40% of grid

Source: Energy Consumption by End-Use Sector, Ranked by State, 2010 Rankings, U.S. EIA.

Because of its Size, Texas Consumes Twice as Much Coal as Any other State



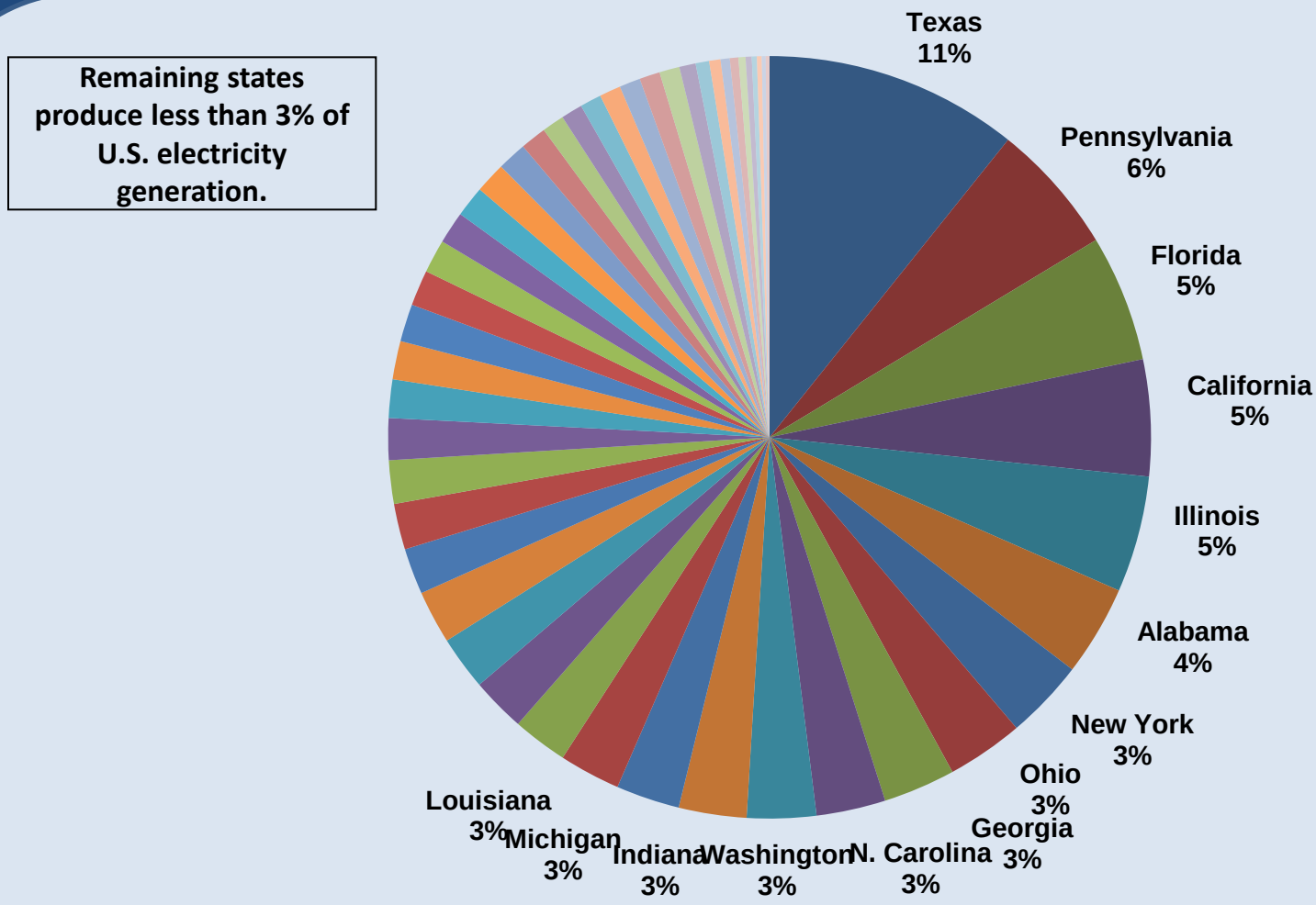
Texas Carrying Disproportionate Burden of EPA Carbon Reductions



- A legitimate claim could be made that Texas should not have to reduce a proportionate share because it produces a majority of our nation's fuels, chemicals and goods (we do everyone's dirty work)
- Yet, when you compare the next two slides, you can see that EPA is not just making Texas carry its share, but almost TWICE its proportionate share (11% of U.S. generation and 18-25% of CO2 reductions)

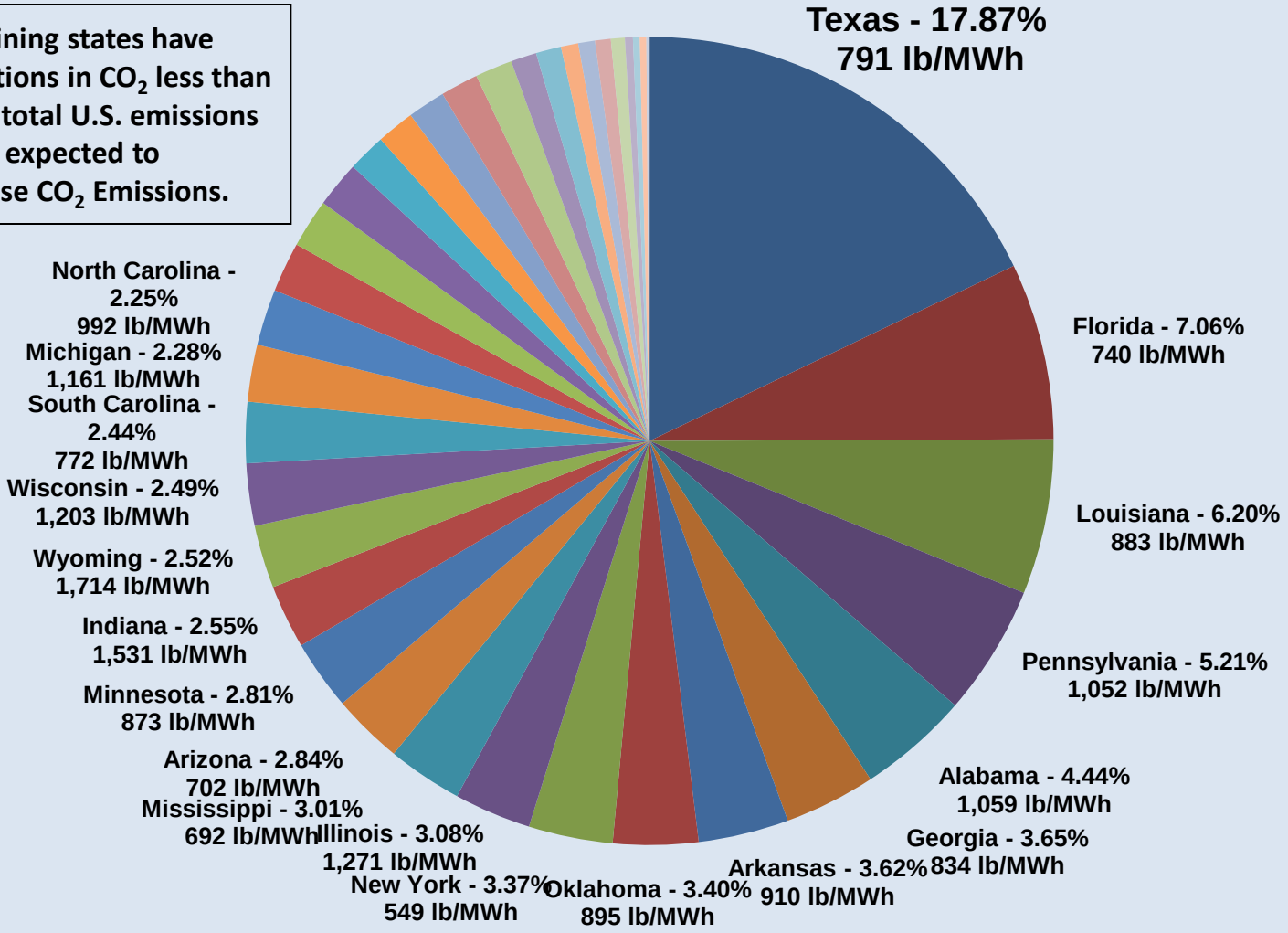
Electricity Production in the United States

Percentage of Total U.S. Production



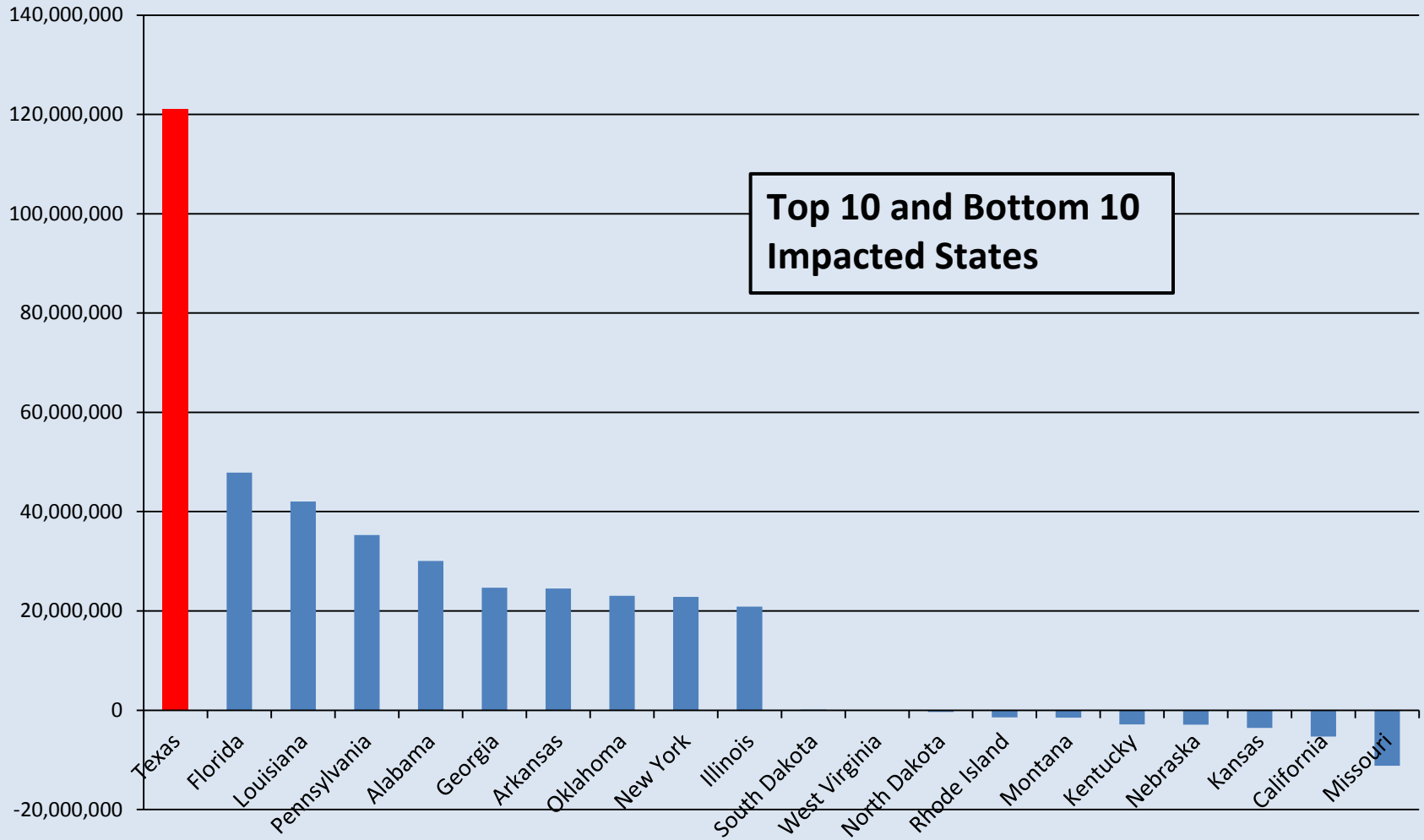
The above graphic demonstrates the share of United States electricity generation by state. Source: EPA's eGrid Database, 2012 Data.

States' Proportion of Total CO_2 Reductions from Electric Generation by 2030 (budgeted rate)



Graph does not include Alaska and Hawaii because data was not available. Vermont is excluded because it is not covered by EPA's rule. The following states were excluded from the graph because they are anticipated to have gains in CO_2 emissions: North Dakota (1.0%), Kentucky (3.0%), California (7.0%), Montana (8.0%), Kansas (10.0%), Nebraska (10.0%), Missouri (14.0%), and Rhode Island (37.0%). Sources: EPA's eGrid 2012 Data & Bloomberg, New Energy Finance analysis (for the rate-to-mass conversion on which percentages are based).

States' CO_2 Reductions from Electric Generation by 2030 (budgeted rate)



Graph does not include Alaska and Hawaii because data was not available. Vermont is excluded because it is not covered by EPA's rule. Sources: EPA's eGrid 2012 Data & Bloomberg, New Energy Finance analysis (for the rate-to-mass conversion on which percentages are based).

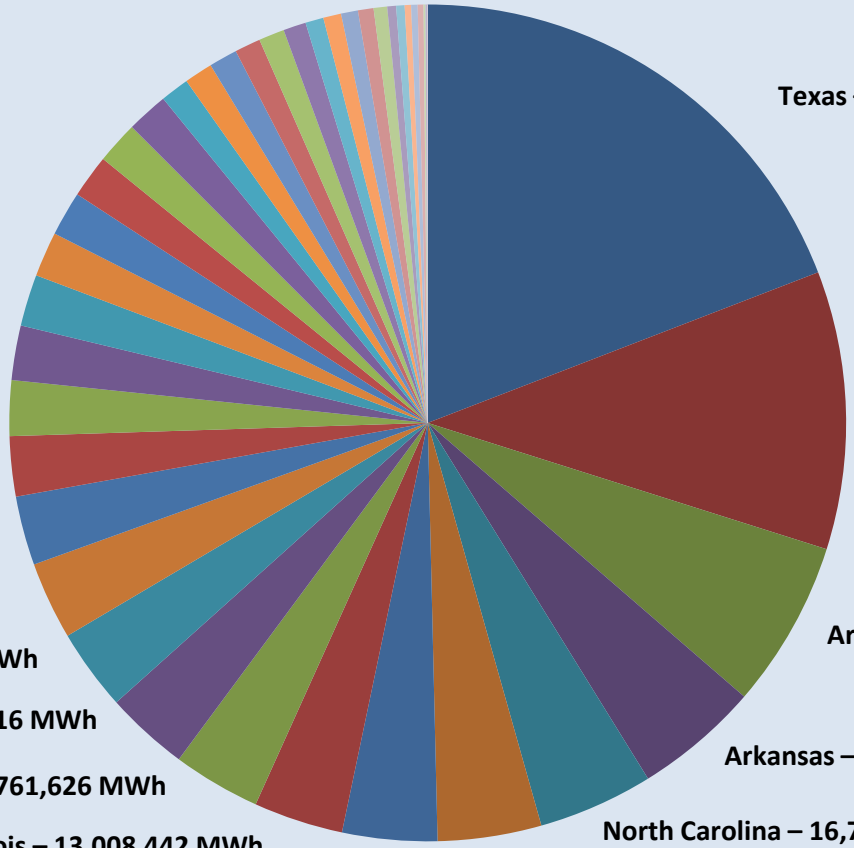
EPA's Modeled Reductions in Coal Generation

All States Impacted By Rule – Final 2030 Target

Remaining state reductions are all below 10,000,000 **MWh.**

* Reductions are based on EPA's assumed coal-to-gas switch and does not include coal retirements driven by: 1) regulatory uncertainty, 2) EPA's 6% additional coal-targeted emissions reductions, or market disadvantages resulting from functionally creating a price on carbon.

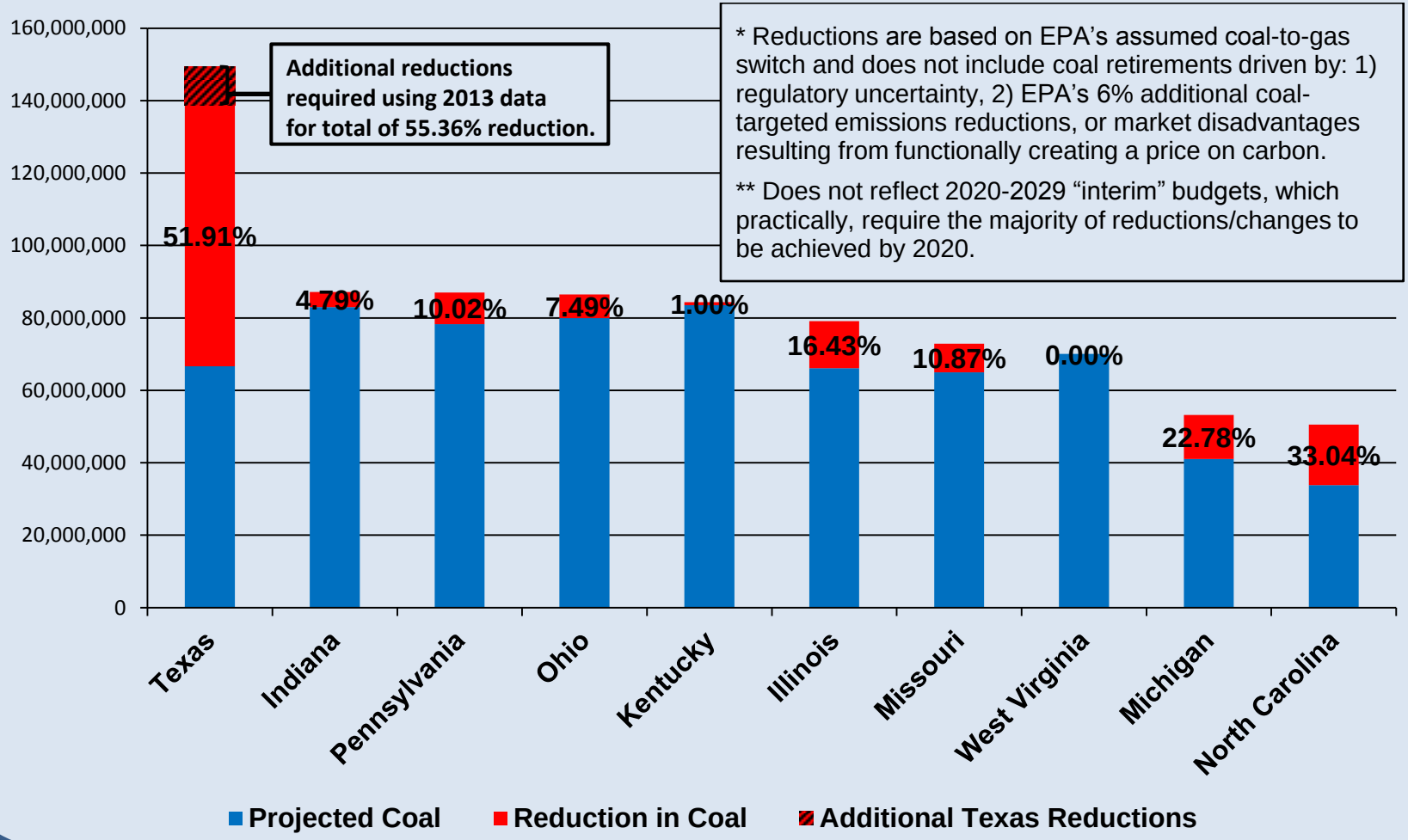
** Does not reflect 2020-2029 "interim" budgets, which practically, require the majority of reductions/changes to be achieved by 2020.



Modeled reductions are shown in megawatt-hours (MWh), comparing 2012 data to EPA's projected 2030 target. Texas is projected to reduce coal generation from 138,705,138 MWh in 2012 to 66,698,233 MWh in 2030 – a reduction of 51.91%. In 2013, Texas coal generation actually reached 149,404,244 MWh, which would result in a difference of 82,706,011 (55.36%) to meet EPA's 2030 target. The above graphic does not include Idaho, Maine, Rhode Island, and Vermont, which do not have coal generation.

EPA's Modeled Reductions in Coal Generation

Comparison of Top 10 Generators of Coal Electricity – Final 2030 Target



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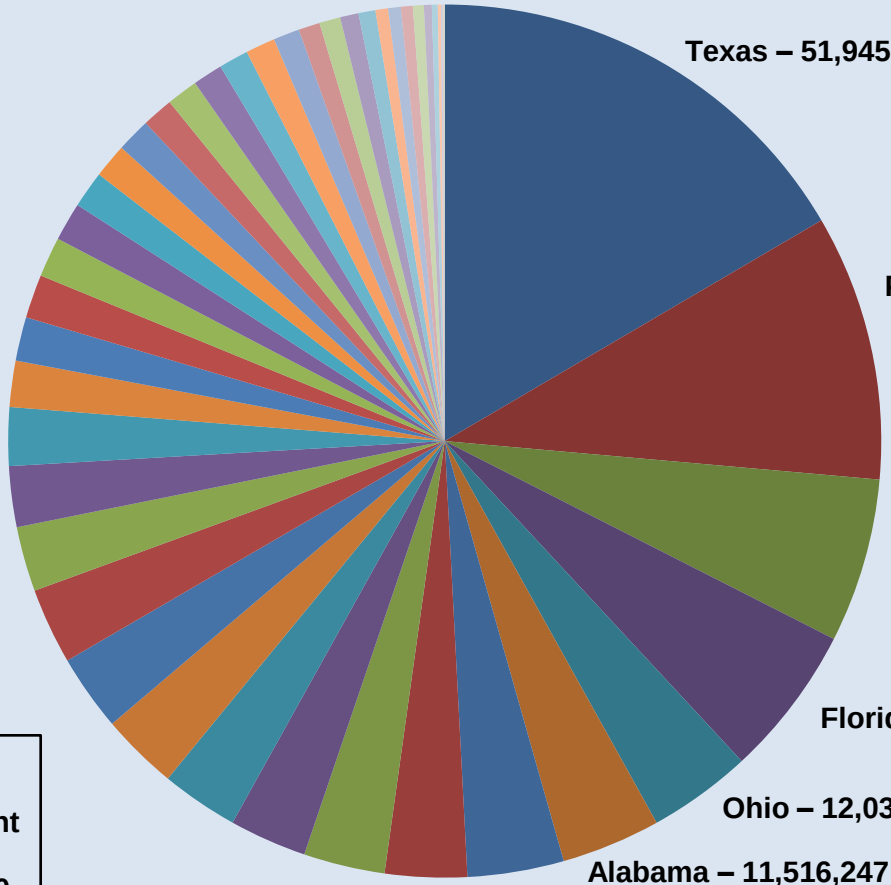
EPA's Modeled Increases in Renewable Electricity

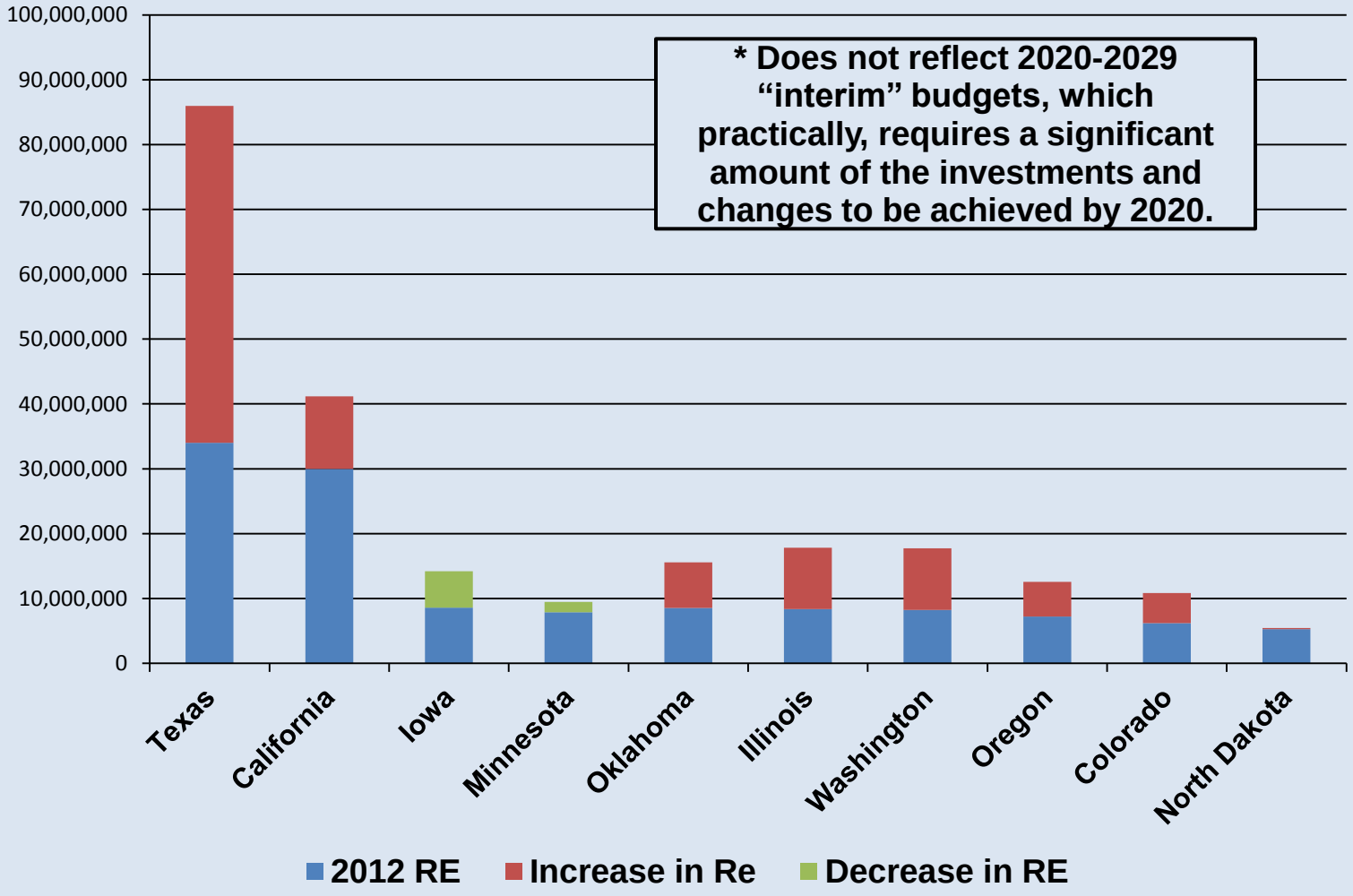
Remaining state increases are all below 10,000,000 MWh.



*** Does not reflect 2020-2029 "interim" budgets, which practically, requires a significant amount of the investments and changes to be achieved by 2020.**

Modeled increases are in megawatt-hours (MWh) comparing 2012 data to EPA's projected 2030 target. Texas is projected to go from 34,016,697 to 85,962,502 MWh in RE – a 153% increase. The above graphic does not include Iowa, Maine, Minnesota, and South Dakota, states in which EPA's model anticipates reductions in RE.

EPA's Modeled Increases in Renewable Electricity (Top Ten Producers)

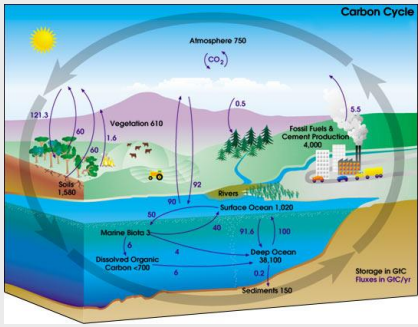


Modeled increases are in megawatt-hours (MWh) comparing 2012 data to EPA's projected 2030 target. . Texas is projected to go from 34,016,697 to 85,962,502 MWh in RE – a 153% increase. California is only modeled to increase renewable electricity generation by 37%. From 2020 to 2030, EPA's model predicts that Texas will increase renewable electricity generation by 114.9%, while California is modeled to increase by 8%.

Texas WILL Fight EPA's Illegal Re-Engineering of our Fleet

- EPA claims states have "flexibility" but the reality of mandated state budgets strictly limit options available to states
- Majority of the rule's reductions come "outside the fence" by assuming fuel-switching & build-out of renewables & efficiency
- Disparate impact on Texas will strike at the heart of the U.S. production of fuels, chemicals, and manufactured goods.
- SIP disapprovals & FIPs could result in unprecedented clash between EPA and states ("Come and Take it")
- Immediate task is to build case for irreparable harm & political intervention to keep the rule from coming into effect

EPA'S Carbon Rule is "All Pain – No Gain"

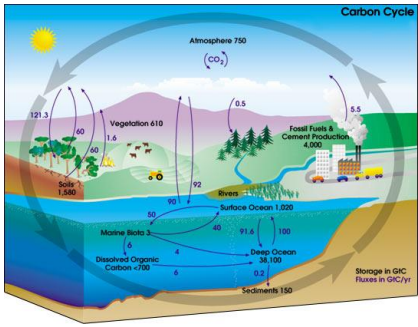


(based on EPA analysis/methodology in light duty vehicle rule and assuming accuracy IPCC projections):

- Addresses only 0.18% of world's CO_2 emissions.
- Global temperature reduced by only 0.01 degrees C
- Mitigation of 0.016 inch of sea level rise; the thickness of 4 sheets of paper or 1/3rd the thickness of a dime)

No Gain

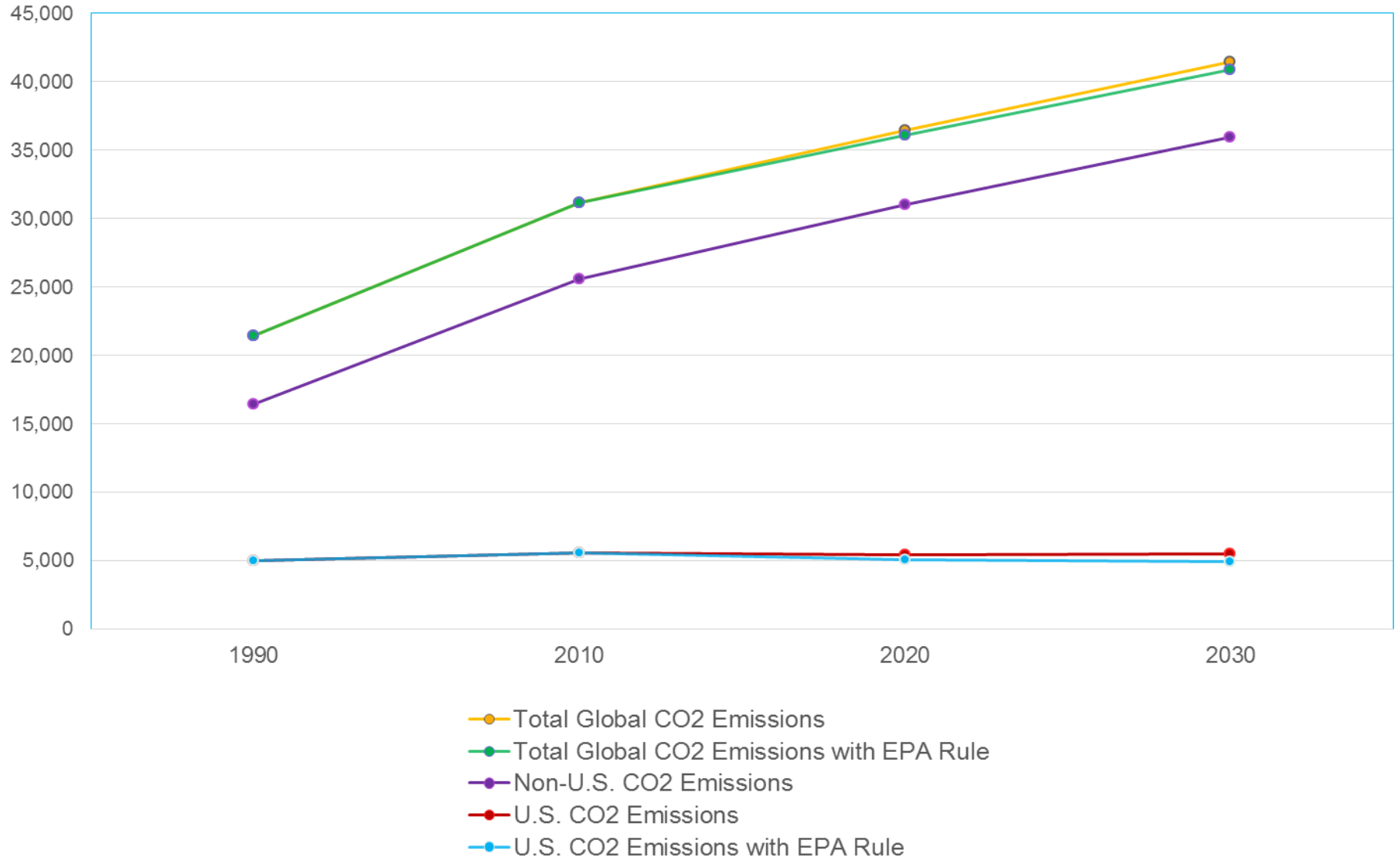
(due to World energy realities)



- Non-U.S. CO_2 emissions are projected to increase 55 percent between 2010 and 2040.
- Between 2011 and 2030, annual non-U.S. power sector carbon emissions are projected to increase by 4,692 million tons
- BOTTOM LINE: 111(d) rule reductions will be offset **more than 8 times over by developing nations**.

U.S. and Global Carbon Emissions Projections

(million metric tons)



Source: EPA Carbon Regulation Proposal, pg 547-548, and www.eia.gov/forecasts/ieo/table21.cfm