



# **Analysis of Draft U.S. Department of Energy Grid Study**

Environmental Defense Fund

Reliable electricity at affordable prices. This mission and mandate is central to the American electric grid and those who oversee it. Over past decades, the energy sector has advanced and incorporated diverse, clean energy sources and new technologies that have decreased costs. This transition has made, and continues to make, electricity more affordable and reliable for Americans. This topic is well-researched, with numerous [reports](#) published by a wide array of organizations from grid operators and national laboratories to independent consultants and government entities. Main conclusion: A clean grid is a reliable grid.

## Background

In April 2017, Energy Secretary Rick Perry [ordered a 60-day study](#) of the U.S. electricity system. As [Bloomberg reported](#) that month, the focus of the study was clear: to determine whether national or state policies have accelerated the retirement of coal and nuclear plants.

[In a letter to his chief of staff](#), Brian McCormack, Sec. Perry's order expressed concern that such policies could pose a risk to our energy security and reliability. The letter clearly outlined Sec. Perry's pre-formed conclusions:

*"[The decrease in baseload power] has resulted in part from regulatory burdens introduced by previous administrations that were designed to decrease coal-fired power generation. Such policies have destroyed jobs and economic growth, and they threaten to undercut the performance of the grid well into the future."*

Sec. Perry's memo included three issues of focus:

- "The evolution of wholesale electricity markets, including the extent to which federal policy interventions and the changing nature of the electricity fuel mix are challenging the original policy assumptions that shaped the creation of those markets."
- "Whether wholesale energy and capacity markets are adequately compensating attributes such as on-site fuel supply and other factors that strengthen grid resilience and, if not, the extent to which this could affect grid reliability and resilience in the future."; and
- "The extent to which continued regulatory burdens, as well as mandates and tax and subsidy policies, are responsible for forcing the premature retirement of baseload power plants."

Given its 60-day timeline, a mid-June release was anticipated.

## Pre-report response

Since its announcement, numerous groups and individuals have expressed concern about DOE's study. Without the standard opportunity for public comment, these groups found other ways to voice their apprehension. For example:

- Senator Chuck Grassley (R-IA) wrote Sec. Perry [a letter stating](#) the study, “which appears to pre-determine that variable, renewable sources such as wind have undermined grid reliability, will not be viewed as credible, relevant or worthy of valuable taxpayer resources.”
- Several environmental groups [wrote Sec. Perry a letter](#) recommending the study include an analysis of all the subsidies the coal industry receives – and has received for decades.
- The natural gas industry [expressed concern](#) after Trump administration officials implied that coal was more reliable because [it's less of a target to terrorists](#).

In addition to the concerns voiced by the parties above, there is already a [robust body of research](#) on the reliability of the U.S. grid. Details vary by study and topic, but the overwhelming analysis and evidence concludes that reliability is improving as America's fuel mix becomes increasingly more diverse and clean. Research overwhelmingly finds that grid operators around the country are doing an impressive job of integrating new fuel sources like wind and solar, while adjusting to the retirement of coal plants and lower than expected demand growth.

EDF has a long history with Sec. Perry and has expressed skepticism about this study's objectivity. During his 14 years as governor of Texas, Perry oversaw – and often boasted about – Texas' remarkable increase in wind generation. His policies and actions as governor, however, were decidedly pro-coal.

## A draft emerges

In late June, the Department of Energy confirmed the report was delayed indefinitely.

On July 14, [Bloomberg reported on and released a draft](#) of the DOE report that had not yet been edited by DOE political staff or presented to Sec. Perry.

Though the document is a draft, it provides an insightful glimpse into a thorough and thoughtful analysis of the U.S. grid. In a nutshell, it concludes: natural gas, not renewables, has largely caused the decline of coal; more clean energy, and less coal, makes the grid more affordable and reliable; and clean energy can lower electricity costs for customers.

Despite media reports that [large sections of this draft have already been removed](#), it is unclear how extensively this draft will be revised before a final report is released or what policy recommendations Sec. Perry's political appointees will develop.

The entire draft document can be downloaded [here](#).

## Key takeaways from leaked DOE grid study

Upon detailed review of the leaked draft, the study outlines five key takeaways that directly address Sec. Perry's memo:

1. "Baseload" resources, as Perry defines them, are not necessary to preserve grid reliability
2. Coal and nuclear plants have been retiring primarily due to low gas prices and flattened demand
3. The U.S. grid is operating reliably, with ample resources to meet demand
4. Renewable energy sources like wind and solar can improve grid reliability
5. Clean energy can lower electricity costs for customers

All of the following citations below, unless noted otherwise, refer to the printed page and line number of the draft DOE report available for download [here](#).

### TAKEAWAY 1

#### **"Baseload" resources, as Perry defines them, are not necessary to preserve grid reliability**

Sec. Perry's April 2017 memo stated that "baseload power is necessary to a well-functioning grid." But "baseload" is not a term industry uses to describe reliability.

The term baseload is used to describe the minimum level of electricity that customers demand around the clock. The electric industry refers to baseload generation as the power plants that are used to meet baseload. Historically, large nuclear, coal-fired, natural gas-fired steam, and run-of-river hydroelectric plants have been used for baseload generation.

The draft notes that "baseload" is a dated term and is not a core-ingredient of reliability.

*"[b]aseload power was useful to a well-functioning grid over the decades from 1960 to 1990, when these plants were initially built. But with technology and market changes, the bulk power system has changed markedly and high-value market and reliability require different services and capabilities to attain high reliability and resilience."*  
(page 79, line 1745-1748)

*"There are four principal ways to maintain and enhance bulk power system reliability: technology, rules and standards, business practices, and using high (and expensive) levels of transmission and generation."* (page 85, line 1808-1809)

The draft also includes the distinction made by NERC between baseload generation and the characteristics of generation providing reliable baseload power. The NERC letter cited provides that “baseload’ generation is not a requirement.”

## TAKEAWAY 2

### Baseload plants have been retiring primarily due to low gas prices and flattened demand

The draft report found that many baseload retirements are consistent with observed market forces. The draft states quite plainly that “*Many baseload plant retirements are not premature.*” (page 9, line 236)

*“Retirements have been due primarily to flattened demand and low electric prices and the inability to compete successfully due to plant age, inefficiency and capital needs rather than regulatory burdens.”* (page 31, line 755-757)

*“Most of the power plants retired were 40 years old or older by their retirement date.”* (page 33, line 781)

The draft cites three outside studies that address the causes of baseload power plant retirements:

1. “Columbia University ‘Can Coal Make a Comeback,’ found that  
- **49% of the collapse of the domestic coal industry has been due to increased competition from high volumes of low-cost natural gas,**  
- 26% from lower-than-expected electricity demand, and  
- 18% due to the growth of renewable energy.” (emphasis added by EDF, page 37, line 865-868)
2. “The draft Lawrence Berkley National Lab study ‘Power Plant Retirements: Trends and Possible Drivers,’ (June 2017) found the strongest correlations to coal, nuclear and natural gas-fired plants lie with the diminishing load growth, high summer planning reserve margins (i.e. over-capacity), coal plants using high SO<sub>2</sub> emissions rates (i.e. costly environmental upgrades), low natural gas prices, and advancing generator age.” (page 37, line 865-868)
3. “Analysis Group study ‘Markets, Reliability and the Evolving U.S. Power System,’ (June 2017) looked at the decrease in prices per MWh in the PJM market (since that decrease would go straight to a coal plant’s bottom line) and concluded that of an almost \$30/MWh price drop, **\$28.00 of the price decline was due to the decrease in natural gas prices,** \$1.00 was due to the drop in electric demand growth, **and \$0.39 would be due to new wind generation operating at full capacity.**” (emphasis added by EDF, page 37, line 874-879)

For those baseload retirements that could be considered premature, the draft specifies that environmental regulations and subsidized renewable generation have played “minor roles” compared to the long-standing drop in electricity demand relative to previous expectations and years of low electricity prices driven by high natural gas availability.

*“Costly environmental regulations and subsidized renewable generation have exacerbated and accelerated baseload power plant retirements. However, those factors played a minor role compared to the long-standing drop in electricity demand relative to previous expectations and years of low electric prices driven by high natural gas availability.”* (page 9-10, line 248-251)

For instance, baseload plant retirements due to age, inefficiency, and inability to compete began appearing in the early 2000s, well before any significant levels of wind and solar generation in any region of the country. The fact that the growth in variable renewable generation did not solely cause baseload retirements is obvious in the Southeast, which has seen significant retirements in recent years but has almost no renewable generation.

### **TAKEAWAY 3**

## **The U.S. grid is operating reliably and has ample resources to meet demand**

*“Most of the common metrics for grid reliability suggest that the grid is in good shape despite the retirement of many baseload power plants.”* (page 76, line 1670-1671)

The draft cites the “common, positive findings” of NERC’s 2016 Long-Term Reliability Assessment and the 2017 State of the Reliability report. (page 77, line 1689-1690)

- *“There were no severe grid events on the bulk power system in 2016.”*  
(page 77, line 1691)
- *“Significant causes of system problems, including protection system mis-operations, are declining and have been declining for four years.”*  
(page 78, line 1692-1693 – note, PDF cutoff makes this appear to be line 692)
- *“System resiliency to severe weather continues to improve.”*  
(page 78, line 1697 – note, PDF cutoff makes this appear to be line 697)

In every region but ERCOT, *“reserve margins (as of the 2016 calculation) comfortably or significantly higher than the levels which would raise a resource adequacy flag or signal potential reliability problems.”* (page 77, line 1677-1680)

The draft includes a table (Table 4.1, page 77, line 1674) highlighting that in all regions (except ERCOT) the capacity is at least 18.7% higher than needed. ERCOT’s reserve margin is 14.5%. The highest (PJM) is 28.9%.

## TAKEAWAY 4

### Renewable energy sources like wind and solar improve grid reliability

The draft report shows renewable energy can improve grid reliability.

- Increased diversity *“enhances bulk power system reliability and resiliency rather than compromising it.”* (page 89, line 1861-1863)
- *“Numerous technical studies for most regions of the nation indicate that significantly higher levels of renewable energy can be integrated without any compromise of system reliability.”* (page 84, line 1804-1805 – note, line numbers are hard to identify)

A table on page 84-85 includes the achievable renewable penetration level by region. 33% wind and solar penetration is achievable in the Western United States.

- NREL and E3’s “WECC Flexibility Assessment” in December 2015 put this figure at 40%.
- According to “Investigating a higher renewable portfolio standard in California” by E3, ECCO International & DNV KEMA (January 2014), the figure is 50% for California.
- Figures for other regions are as follows, but citations are not provided in the draft: New England - 24%, Midwest (MISO and SPP) – 25%; Eastern U.S. – 30%; and national – 50%.

An entire section is named “High levels of wind penetration can be integrated into the grid without harming reliability” (page 101, line 2106-2108). This section appears to include excerpts from other studies or assessments:

- *“The ability of wind power plants to provide PFR (primary frequency response)—and a combination synthetic inertial response and PFR —significantly improved the frequency response performance of the system.”* (page 102, lines 2134-2136, possibly citing NREL “Role of Wind Power in Primary Frequency Response”)
- *“Renewable generators also can provide frequency control. Many new wind and solar facilities have components called 'active power controls,' which allow their output to be increased or decreased to help maintain reliability. These controls allow renewable generators to provide primary frequency response that is similar to that of the automatic governors on conventional power plants. Using these, they can quickly and automatically adjust their output to help stabilize grid frequency.* (page 102-103, lines 2139-2142, possibly citing “Powering into the Future: Renewables and Grid Reliability,” MJ Bradley, 2017)
- *“PJM found that a 30 percent regional variable renewable penetration level – adding over 100,000 MW of renewable power – requires no additions in operating reserves and only 1,500 MW (or 1.5 percent of renewable capacity) or quick ramping regulation*

*generation.*” (page 103, lines 2152-2154, possibly citing “Powering into the Future: Renewables and Grid Reliability,” MJ Bradley, 2017)

The draft includes an excerpt from a USA Today story featuring Nick Akins, CEO of American Electric Power:

*“Nick Akins, the CEO of American Electric Power. one of the largest utilities in the U.S., says the preference for gas, renewables and energy efficiency, will only grow in response to increasing demands from shareholders and customers for cleaner energy, regardless of changes in national energy policy.”* (page 90, line 2039)

Finally, the draft asks and answers *“Will removing renewables subsidies and RPS make renewable generation go away (and presumably put less pressure on coal and nuclear plants)? No.”* (page 93, line 1945-1946)

## **TAKEAWAY 5**

### **Clean energy can lower electricity costs for customers**

Sec. Perry’s memo specifically asks whether the loss of coal, natural gas and other power sources is making electricity less affordable. The draft carefully points out that future costs are hard to predict, but offers explanation about how a diversified fuel mix, including more renewable energy, can control costs to customers.

- *As discussed in Section 3, coal and nuclear power have become more costly while natural gas has become much less so.* (page 119, line 2616-2617)
- *Wind and solar generation have high capital costs but their marginal cost is nearly zero.* (page 119, line 2617-2618)
- *Efforts to retain many of the high-cost baseload plants that are now retiring may end up raising rather than lowering the average cost of wholesale electricity for many customers.”* (page 119, line 2618-2619)

*“One of the benefits of renewable energy is that it can serve as a hedge for more volatile fossil-fueled generation – to the degree that renewable energy stabilizes the cost of an overall energy portfolio (or even just a customer’s bill), that affects perceived affordability.”* (page 119, line 2631-2634)

The draft outlines two reasons that a diverse energy mix is important to customers:

1. *“Consumers reveal a strong preference for not paying more than they have to for reliable electricity,” and*
2. *And “[c]onsumers reveal preferences for some degree of predictability and stability in their monthly power bills.”* (page 90, line illegible)

*“Some electricity customers have established a strong preference for renewable energy; an increasing number of businesses have made commitments to use renewable energy (e.g.,*

*Walmart, Amazon, and Google); and utilities are also restructuring their purchase patterns and resource portfolios to acquire or own much more renewable energy.” (page 95, line 1987-1991)*