

Military Base Electricity Reliability: No Clear Link to Coal and Nuclear

The Trump administration has argued that national security is at risk due to the reliance of military installations on civilian electric grids, claiming that support for ailing coal and nuclear plants is required to maintain grid reliability, and in turn military readiness. In this note, we analyze government reliability statistics for service at military installations and find that military bases lost service 1.3 times per year on average between 2015 and 2017. Outages led to lost service at military bases lasting a total of 0.003% of the year over the same time period—approximately the same level of service as the average US electric customer. Disruptions on the distribution side of the grid, where interventions to support coal and nuclear plants would have no impact, cause 90% of outages and 95% of lost service hours. We also find that the Department of Defense (DOD) has programs and standards in place to maintain mission critical operations when a rare outage does occur.

The Administration's Argument for Grid Intervention

The Trump administration has made bringing back the US coal industry a key component of its energy policy agenda. Since the election, the administration has attempted action on multiple fronts, including rolling back clean air policies and forcing the Federal Energy Regulatory Commission (FERC) to support coal and nuclear plans in competitive electric power markets.

While the administration proceeded with the rewriting of pollution regulations, electric power market interventions remain stalled. However, officials continue to contemplate additional actions to support coal and nuclear plants on national security grounds. For example, in March 2019, the White House Council on Economic Advisors suggested a strategic need for an electric generation reserve for the purpose of maintaining or improving electric grid resilience with preferential treatment for coal and nuclear plants. Similarly, a draft memo written by the Trump administration's Department of Energy (DOE) (that was made public in 2018) asserted that the continued retirement of uneconomic coal and nuclear power plants could reduce the resilience of electricity supply to critical defense infrastructure, such as military bases across the US. Nearly all military installations in the US rely on the civilian grid as their primary source of electricity. The memo argues that this makes grid reliability a national security issue worthy of government intervention in electric power markets.

In this note, we consider the issue of military installation reliance on civilian electric system infrastructure. We present results of a first-of-a-kind analysis of the frequency and duration of military base electric service disruptions and where on the electric system these disruptions occur. We also review what the DOD and other agencies are doing to shore up the resilience of critical infrastructure.

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The Reliability of the US Electric System

A reliable electric power grid is one that can meet the needs of customers even when unexpected equipment failures or other factors reduce the amount of available electricity. A resilient electric power grid can withstand and reduce the magnitude and/or duration of disruptive events. Electricity is primarily generated at large, centralized power plants and sent over high-voltage transmission lines to load centers. These generators and the interconnected transmission networks that send electricity over long distances make up the bulk power system. Electricity from the bulk power system is stepped down to a lower voltage at local substations and sent to customers over the local distribution network.

Under authority granted in the Energy Policy Act of 2005, reliability standards written and enforced by the North American Electric Reliability Corporation (NERC) and approved by FERC apply to the bulk power system. State Public Utility Commissions and other regulatory boards oversee reliability requirements for local distribution systems. Both the bulk power system and the local distribution network must function properly to reliably deliver electricity to customers. It is important to keep the customer—in this case, military installations and critical military infrastructure—in mind when considering the current state of reliable and resilient provision of electric services and potential efforts to improve that service.

The US electric system is highly reliable. While individual power plants and other system components may experience disruptions from time to time, they tend not to lead to service outages for customers. Adherence to reliability standards, smart planning, and sophisticated operation by regional transmission operators and utilities allow highly reliable service for the average US consumer. Looking at the entire electric system inclusive of distribution, the average US utility customer experienced 1.4 service outages in 2017, equivalent to losing service for 0.09% of the year. This high level of performance was achieved in a year when multiple hurricanes and severe winter storms battered the East Coast.¹

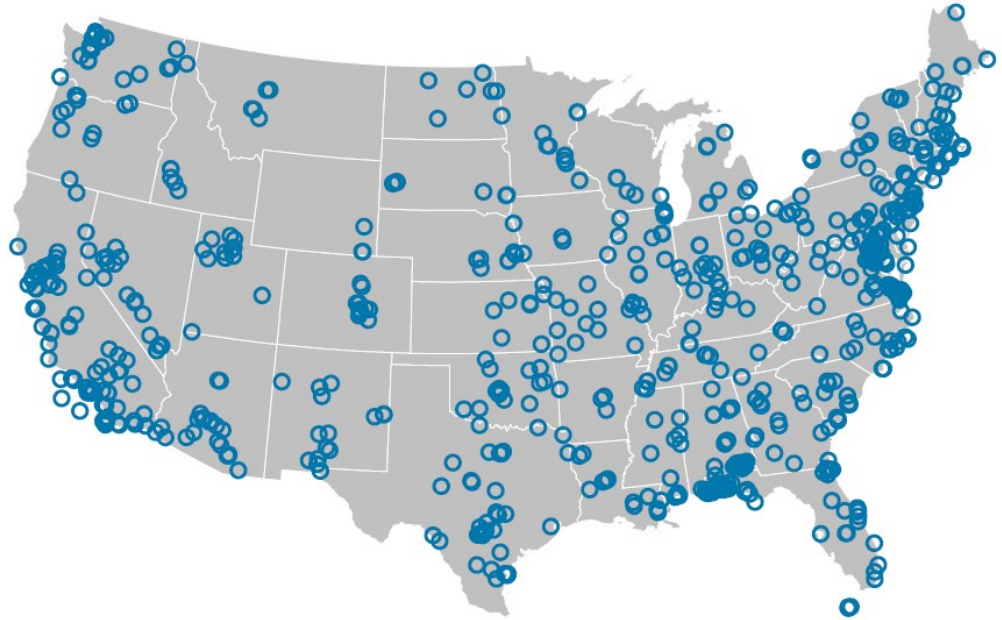
Assessing the Reliability of Electric Service at Military Installations

To analyze the reliability of civilian electric service to military installations, we consider data that encompasses performance across the entire electric system, both bulk power and distribution. The ability to generate electricity at central power plants is not helpful to military installations if transmission or distribution network disruptions prevent delivery.

The US military has 750 active duty and reserve installations across the continental US that use the civilian power grid as their primary source of electricity (Figure 1). Military installations do not publicly report the utility from which they receive electric service or the quality of that service. The US Energy Information Administration (EIA) reports [detailed electric utility data](#) on an annual basis, including the service territory for each of the roughly 3,100 utilities in the US. The same report includes electric system reliability statistics for entities serving 92% of customers nationwide. The military publishes the location of installations. Using geospatial analysis, we estimate which utility serves each installation by matching locations to service territories. Some installations have large footprints and overlap with multiple service territories. In these instances, we consider data from all utilities that could potentially serve a given installation. The merger of these data sets allows us to examine the reliability of civilian electric service to military installations.

¹ Though 2017 also marked the beginning of the world's [second largest blackout](#), these numbers reflect customers in the 50 states and DC only.

FIGURE 1

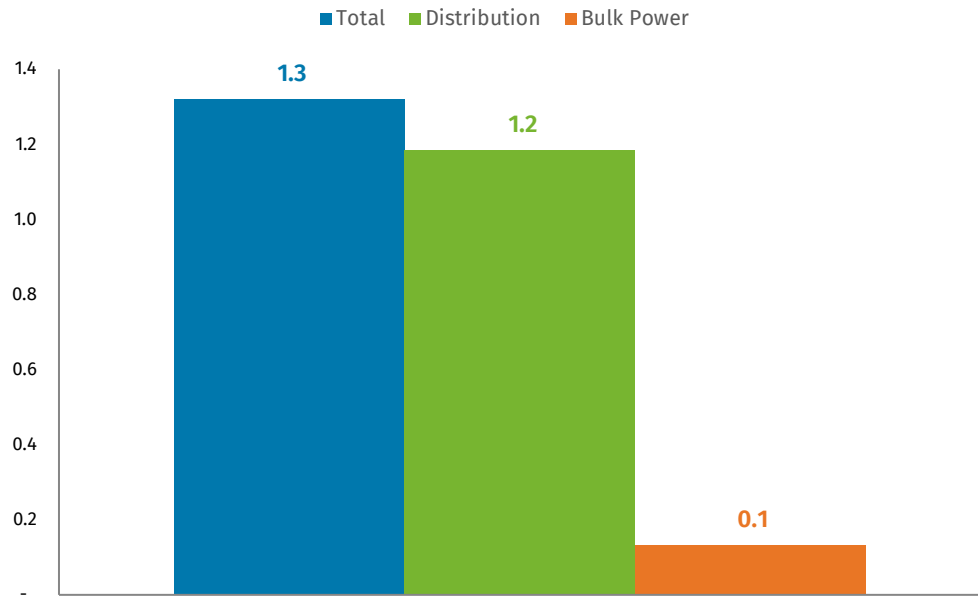
Locations of active duty and reserve military installations in the continental US

Source: Department of Defense, Rhodium Group analysis

For this analysis, we examined utility reliability performance data for the years 2015 through 2017. Not all utilities reported complete performance data to EIA. We considered only complete data, which represents approximately 75% of the utility service data associated with military installations, and we did not weight installations to account for their relative contribution to the nation's security. We find that military installations experienced 1.3 outages per year on average from 2015 through 2017, roughly the same performance as the average for all utility customers. (Figure 2). Of that average, distribution system disruptions caused 1.2 outages per year while bulk power disruptions caused 0.1 outages per year. Putting it another way, disruptions on the bulk power system were responsible for just 10% of outages at military installations on average over these three years. After a review of the geographic distribution of reliability statistics, we did not find any "hotspots" or areas of the country where military installations experienced unusually high reported frequency or duration of outages.

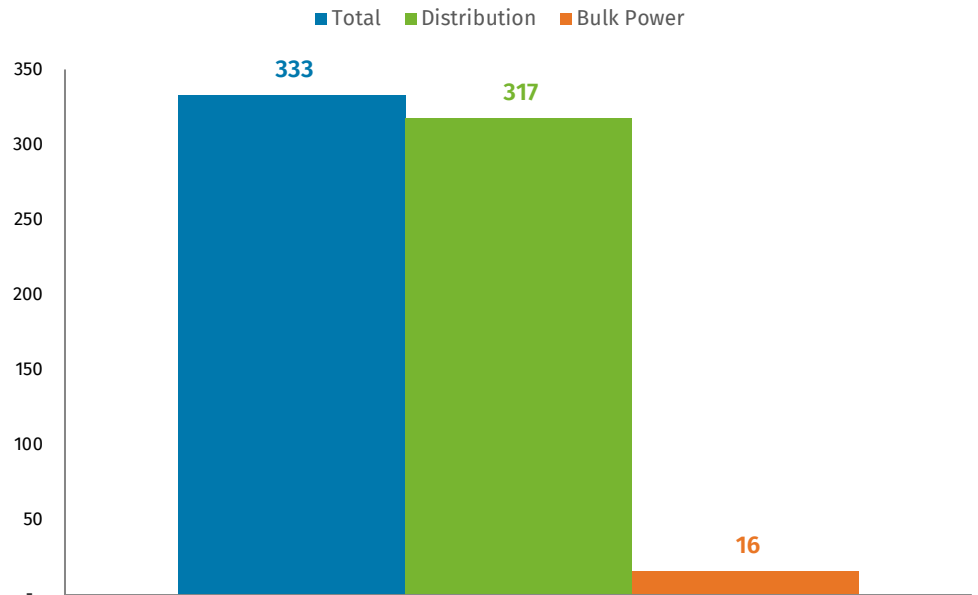
Turning to the duration of service outages at military installations, we find similar results. On average military installations experienced 333 minutes of lost service each year from 2015 through 2017 (Figure 3). We find 95% of the total or 317 minutes of lost service were due to distribution system disruptions while 5% or 16 minutes were due to bulk power disruptions. This means that the bulk power system, the focus of the Trump administration's suggested interventions to improve national security, is responsible for 0.003% of the service lost each year, on average, at military installations.

FIGURE 2
Average frequency of electric outages at military installations by cause, 2015-2017
 Number of occurrences per year



Source: Rhodium Group analysis

FIGURE 3
Average duration of electric outages at military installations by cause, 2015-2017
 Minutes of lost service per year



Source: Rhodium Group analysis

With military installations on average experiencing 1.3 outages per year that result in 333 minutes of lost service each year—roughly .063% of the year without power—we find that the civilian grid provides reliable service. Federal efforts to improve bulk power system reliability will at best avoid the loss of 16 minutes of service, on average, each year. But what if more coal and nuclear plants retire in the future? Will bulk power disruptions increase and threaten reliability at military installations? This

is an unlikely outcome. In [previous analysis](#) we found no clear link between low levels of coal and nuclear generation and higher frequency of outages nationwide.

Our results show that 90% or more lost service hours and outages at military installations are caused by disruptions in utility distribution systems. If the federal government wants to improve the reliability of electric service to military installations it could prioritize programs for vegetation management, equipment upgrades, and network management systems to reduce disruptions from weather events and speed up recovery times. These investments have the potential to be far more helpful in maintaining national security than interventions to support coal and nuclear plants.

Existing Defense Department Programs Support Critical Military Infrastructure

Electric reliability, resilience, and security are not new concerns for the DOD. A [2008 report](#) of the Defense Science Board Task Force on DOD Energy Strategy warned of the risks that loss of grid power could pose to critical missions. In 2012, the DOD [Electric Power Resilience Working Group](#) conducted a review of resilience policies and identified gaps in those policies. In 2013, [RAND Corporation](#) published recommended actions in “Capabilities-Based Planning for Energy Security at Department of Defense Installations.” [DOD Directive 4170.11](#), updated in 2016, requires installations to have backup generation systems or other resilience solutions in place for critical infrastructure. These systems are needed to keep critical operations running in the low-probability event of a civilian grid outage.

While DOD and the national defense community continue to make progress on improving electricity reliability and resilience at military installations, further efforts can be made on the ground to enhance distribution systems. Some installations have a large footprint, and the military is responsible for the reliable performance of these systems once power is delivered from the civilian grid. A [2016 report from the Massachusetts Institute of Technology’s \(MIT\) Lincoln Laboratory](#) identified unreliable distribution systems on bases as the primary cause of installation electric service outages reviewed in its assessment. In their words, “[c]ritical missions will continue to experience outages if the reliability associated with the base’s electrical distribution system is not addressed. In some cases, a base receives a high level of reliability from the commercial electric system, only to see it degrade as the power makes its way onto the base and to the critical energy load in question.”

Shoring up military installation distribution systems and deploying effective backup power for mission critical operations, are areas where DOD is already hard at work. When taking into account the small role bulk power system disruptions play in military installation reliability and resilience, it appears that further resources devoted to these efforts have the potential to provide a larger national security benefit than interventions to support coal and nuclear plants.

Disclosure Appendix

This research was prepared for the American Petroleum Institute, Environmental Defense Fund and Natural Resources Defense Council and is part of a two-report series. The research was conducted independently by Rhodium Group, LLC. The findings and views expressed in this note are the authors' alone. This material was produced by Rhodium Group LLC for use by the recipient only. No part of the content may be copied, photocopied or duplicated in any form by any means or redistributed without the prior written consent of Rhodium Group.

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