REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Washington Headquarters Service, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington, DC 20503.
PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
xx-08-2019	LLM Thesis	

4. TITLE AND SUBTITLE

"ENERGY RESILIENCY" – HOW DOD CAN BECOME ENERGY RESILIENT AND STILL MEET ITS RENEWABLE ENERGY GOALS

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

Reintjes, Christopher M., LCDR, JAG Corps, U.S. Navy

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Civilian Institutions Office (Code 522)
Naval Postgraduate School
1 University Circle, Herrmann Hall Rm HE046
Monterey, CA 93943-5033

10. SPONSOR/MONITOR'S ACRONYM(S)

NPS CIVINS

11. SPONSORING/MONITORING AGENCY REPORT NUMBER

12. DISTRIBUTION AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

The DoD has several new authorities it can use to help it prioritize renewable energy development by weighing the benefits unique to these sources, but it requires the DoD to create new energy resiliency metrics and installation resiliency plans; modify its traditional cost-benefit analysis to properly weigh the benefits of onsite production of energy and fuel savings associated with renewable energy; and make investments in new micro-grid technologies that can decouple the DoD from the aging commercial grid and that may encourage third-party energy partnerships.

15. SUBJECT TERMS

energy security; renewable energy; energy resilience; 2018 National Defense Authorization Acts (NDAA); 2019 NDAA;

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			19b. TELEPONE NUMBER (*Include area code)*
U	U	U	UU	21	

THIS PAGE INTENTIONALLY LEFT BLANK

"ENERGY RESILIENCY" – HOW DOD CAN BECOME ENERGY RESILIENT AND STILL MEET ITS RENEWABLE ENERGY GOALS

BY

CHRIS M. REINTJES[1]

VERMONT LAW SCHOOL
2018-2019

[1] Chris Reintjes is a U.S. Navy Judge Advocate serving in the rank of lieutenant commander. Currently pursuing his LLM at the Vermont Law School, he earned his JD from the Pennsylvania State University's Dickinson School of Law in Carlisle, PA, his MA in defense and strategic studies from the Naval War College, and his BS in chemical engineering from the University of Notre Dame. A former naval surface warfare officer, he has served onboard ship and with the U.S. Marine Corps Special Operations Command. His assignments as a judge advocate include those as a government prosecutor, defense counsel, staff judge advocate at various levels of the Navy, and as an administrative law attorney. ***The positions and opinions in this Article are those of the author and do not necessarily represent the views of the U.S. Government, the Department of Defense, or the U.S. Navy.***

ABSTRACT

Since 2005, Congress has required the Department of Defense (DoD) to make strides towards achieving renewable energy goals – increasing its consumption and production of renewable energy. The focus was on cost-savings and reducing environmental impacts. Very little thought was given to how these initiatives would improve the energy security and resilience of the DoD. All that has changed. In December 2017 and August 2018, Congress passed the Fiscal Year (FY) 2018 and 2019 National Defense Authorization Acts (NDAA). The FY18 NDAA officially established an energy policy of the DoD by amending a longstanding statute, which since 2006 simply outlined energy performance goals for the DoD, such as energy conservation and the use of renewable energy sources. The FY18 NDAA mandates that the Secretary of Defense (SecDef) "ensure the readiness of the armed forces for their military missions by pursuing energy security and energy resilience."

This new energy resilience and security mandate may make achieving DoD's renewable energy goals less likely. With increasing U.S. supplies of domestically produced natural gas and correspondingly decreasing prices, the DoD is poised, and potentially supported by Congress, to make the easy decision of focusing on short-term gains in energy resiliency and security by increasing its supply of and reliance on cheap fossil fuels and traditional backup generators. However, in the long run, this could be to the detriment of the long-term energy resilience and security of the DoD. It is important that the DoD find a way to incorporate renewable energy systems while simultaneously satisfying its energy resilience and security mandate.

The DoD has several new authorities it can use to help it prioritize renewable energy development by weighing the benefits unique to these sources, but it requires the DoD to create new energy resiliency metrics and installation resiliency plans; modify its traditional cost-benefit analysis to properly weigh the benefits of onsite production of energy and fuel savings associated with renewable energy; and make investments in new micro-grid technologies that can decouple the DoD from the aging commercial grid and that may encourage third-party energy partnerships.

TABLE OF CONTENTS

INTRODUCTION

The U.S. is more dependent than ever on reliable access to energy, in both the military and the civilian sectors. Advanced weapons systems, sensors (such as land-based surveillance and radar systems),[2] and military communications systems require large amounts of energy, and these systems do not respond well to power disruptions.[3] Numerous technological advances have also made sophisticated, energy-demanding technologies more affordable and common place in civilian workplaces and homes. For example, a recent Pew Research Center study shows that a record 95% of Americans own cell phones and 77% of cellphone owners own smart phones – a rise of 35% since 2011.[4] The typical American home or car is full of charging cords hiding wherever a plug is handy.[5] Electric vehicles and their charging stations are appearing all over the country and on military installation at an ever increasing rate – a trend that will likely accelerate as electric vehicle production continues to rise.[6]

At present, the energy security of both the U.S. military and the civilian population are inextricably linked because they mostly share the same electric grid system.[7] When disaster strikes any part of the U.S. grid system, U.S. military readiness is potentially at risk. In many cases, military installations are at a higher risk of power disruptions due to their often-remote locations, or simply due to inadequate maintenance onboard the installation where the military, rather than the electric company, is responsible for maintenance. Recent natural disasters, operator errors, and physical and cyber-attacks have revealed the vulnerabilities of the U.S. electrical grid and made energy resilience an issue of paramount concern for the military.

Although U.S. domestic energy consumption has decreased in recent years due to widespread adoption of energy efficient lighting and appliances,[8] our reliance on energy has increased. From online food ordering to navigation, Americans rely heavily on electricity and the internet. If you lost your phone, do you even know the phone number of the person you would need to call for help? Do you have their number memorized or written down? Most people likely don't.[9] What would your alternative be if you couldn't access the internet? Do you even have an alternative? Does the military? The Pentagon is crammed with office cubicles. Inside each cubicle, there is a computer system (if not multiple computer systems),[10] and the military relies heavily on these systems.

---

[2] See e.g., Sydney Freedberg Jr., *Aegis Ashore: Navy Needs Relief From Land*, BREAKINGDEFENSE.COM (Jul. 2, 2015), https://breakingdefense.com/2015/07/aegis-ashore-navy-needs-relief-from-land/.

[3] Gretchen Bakke, *The Grid* (2016) xxviii (stating that the U.S. military is "unable to tolerate even the tiniest of voltage fluctuations.").

[4] *Mobile Fact Sheet*, PEW RESEARCH CENTER (Feb. 15, 2018), http://www.pewinternet.org/fact-sheet/mobile/.

[5] Even our coolers have gone high-tech and boast charging stations for our cellular devices. See, The Coolest Cooler at https://coolest.com/.

[6] According to FORBES.COM, global electric vehicle sales in 2017 topped nearly 1.2 million and are expected to climb to 2 million in 2019. Sarwant Singh, *Global Electric Vehicle Market Looks to Power up in 2018*, FORBES.COM (Apr. 3, 2018), https://www.forbes.com/sites/sarwantsingh/2018/04/03/global-electric-vehicle-market-looks-to-fire-on-all-motors-in-2018/#31aafa662927.

[7] Office of the Assistant Secretary of Defense for Energy, Installations, and Environment, *Installation Energy (IE)*, U.S. DEP'T OF DEF., https://www.acq.osd.mil/eie/IE/FEP_index.html (last accessed Nov. 3, 2018)

[8] Lucas Davis, *Evidence of Decline in Electricity Use by U.S. Households*, ENERGY INSTITUTE AT HASS (May 8, 2017), https://energyathaas.wordpress.com/2017/05/08/evidence-of-a-decline-in-electricity-use-by-u-s-households

[9] See e.g., Sarah Nir, *Dumbed-Down Dialing*, NYTIMES.COM (Aug. 27, 2010), https://www.nytimes.com/2010/08/29/fashion/29Noticed.html.

[10] The military operates multiple secure computer systems, which often requires users to have multiple computer systems at the workstations.

It is due to this ever growing dependence on energy, that energy resilience and security are quickly emerging as an important national security priority for the U.S. military.[11] These emerging priorities are evident both in the National Security Strategy of the United States (NSS),[12] which outlines the President's strategic concerns for the United States and how he intends to address them,[13] and in the Fiscal Years (FY) 2018 and 2019 National Defense Authorization Acts (NDAA), where Congress sets priorities for the Department of Defense (DoD) and authorizes certain appropriations for DoD construction projects and defense activities of the Department of Energy.[14] The first of the President's NSS objectives is to counter the risks to the nation's critical infrastructure.[15] The NSS identifies the risks to the nation's energy and power infrastructure as being linked to the national security of the U.S. The President and Congress are aligned in their views of the risks posed to the national security due to the U.S.'s vulnerable energy infrastructure.[16] Accordingly, Congress recently directed the DoD to take steps to increase its energy resilience and enhance its energy security.

In December 2017 and August 2018, Congress passed the FY18 and FY19 NDAAs.[17] The FY18 NDAA officially established an energy policy of the DoD by amending a longstanding statute[18] – 10 U.S.C. § 2911 – which since 2006 simply outlined energy performance goals for the DoD, such as energy conservation and the use of renewable energy

---

[11] National Security Strategy of the United States of America, WHITE HOUSE (Dec. 2017), https://www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf (hereinafter NSS). See also, Bruce J. Walker, *Strengthening the Security and Resilience of the Nation's Critical Energy Infrastructure*, ENERGY.GOV (Jul. 2, 2018), https://www.energy.gov/oe/articles/strengthening-security-and-resilience-nation-s-critical-energy-infrastructure; Sec. of Energy Rick Perry cover letter to the *Staff Report to the Secretary on Electricity Markets and Reliability* (Aug. 23, 2017), https://www.energy.gov/sites/prod/files/2017/08/f36/Secretary%20Perry%20Grid%20Study%20Cover%20Letter.pdf.

[12] In 1986, Congress passed the Goldwater-Nichols Defense Department Reorganization Act, which in part required the President of the United States to annually submit a comprehensive report to Congress on the national security of the United States (50 U.S.C. § 3043). The report, meant to inform the Congress of the President's view of our national security, outlines the President's foreign and domestic priorities that he deems vital to the national security of the United States, the current ability, or lack thereof, to satisfy these priorities, and the proposed long and short-term uses of military, political, and economic elements of the national power of the United States to protect or promote the interests of the United States (50 U.S.C. § 3043(b)(1)-(5).

[13] The current strategy focuses on four pillars, the first of which is to "Protect the American People, the Homeland, and the American Way of Life" (National Security Strategy (NSS) at *v*). This first pillar includes "promoting American resilience," which calls for identifying and countering the risks to the critical infrastructure of the United States in "six key areas: national security, energy and power, banking and finance, health and safety, communications, and transportation" (NSS at 13).

[14] See e.g., the synopsis of the John S. McCain National Defense Authorization Act for Fiscal Year 2019, Pub. L. No. 115-232, 132 Stat. 1636 (2018) (hereinafter FY19 NDAA).

[15] NSS at 13.

[16] A Senate report accompanying the FY2018 NDAA noted that the DoD "continues to experience multiple utility grid outages every year" which have negative impacts on military readiness" (Senate report accompanying the FY18 NDAA, Senate Report 115-125, 100 (Jul. 10, 2017). The report continued by highlighting the Senate Armed Services Committee's (SASC) concern of the DoD's vulnerability to physical and cyber-attacks, and severe weather events, which it believes "threaten[s] the [DoD's] ability to recover from multi-day utility disruptions on its installations" (*Id.*). The SASC stated that by "improving energy resilience," the DoD will "decrease utility disruptions and grid outages that negatively impact operations and compromise readiness" (*Id.).*

[17] FY18 NDAA § 2831, Pub. L. No. 115-91, 131 Stat. 1283, 1858 (2017) (hereinafter FY18 NDAA); FY19 NDAA, *supra*).

[18] FY18 NDAA § 2831, codified at 10 U.S.C. § 2911(a).

sources.[19] The FY18 NDAA mandates that the Secretary of Defense (SecDef) "ensure the readiness of the armed forces for their military missions by pursuing energy security and energy resilience."[20] Together, the FY18 and FY19 NDAAs added several discretionary authorities that the SecDef can use to help achieve this new energy policy,[21] and the FY19 NDAA requires the SecDef to annually report to Congress the progress made toward achieving energy security and resilience.[22]

"Energy resilience" is defined as the "ability to avoid, prepare for, minimize, adapt to, and recover from anticipated and unanticipated energy disruptions in order to ensure energy availability and reliability sufficient to provide for mission assurance and readiness, including mission essential operations related to readiness, and to execute or rapidly reestablish mission essential requirements."[23] "Energy security" is defined as "having assured access to reliable supplies of energy and the ability to protect and deliver sufficient energy to meet mission essential requirements."[24] In its simplest form, it appears that the SecDef is required to ensure military readiness by increasing energy resilience and securing access to energy supplies. The implications of this new energy policy for the DoD are vast, leading one commentator to describe the FY18 NDAA as the "the most important . . . energy and environmental legislation that most people have never heard of."[25]

One potential implication of this new mandate may be its effect on the DoD meeting its long-established renewable energy goal. In 2006, Congress set a goal for the DoD to produce or procure at least 25% of its energy for facilities from renewable sources.[26] As of FY17, the DoD-wide average was just below 9%.[27] Meeting this renewable energy goal is no small task given that the DoD is the "largest single energy-consuming entity in the United States," consuming nearly 80% of all Federally procured energy.[28] Installation energy – energy used to power military bases – "is nearly five times the total energy consumption of the next closest Federal agency."[29] Installation energy costs represent over 30% of the DoD's total annual energy outlay,

---

[19] 10 U.S.C. § 2911 (2006), added and amended by the FY07 NDAA §§ 2851(a)(1), 2852, Pub. L. No. 109-364, 120 Stat. 2489, 2496 (2006).
[20] FY18 NDAA § 2831, codified at 10 U.S.C. § 2911(a).
[21] 10 U.S.C. § 2911(b)(1)-(5).
[22] FY19 NDAA § 312.
[23] National Defense Authorization Act for Fiscal Year 2018 § 2831, Pub. L. No. 115-91, 131 Stat. 1283, 1858 (2017) (hereinafter FY18 NDAA).
[24] FY18 NDAA § 2831, 131 Stat. at 1858, codified at 10 U.S.C. § 101(e)(7).
[25] Rachel Jacobson, et al., Environmental Deconfliction: the National Defense Authorization Act for Fiscal Year 2018 and Its Implications for Energy Environment, and Natural Resources, 18 PRATT'S ENERGY LAW REPORT 7.01 (Jul./Aug. 2018). Jacobson rightly states that through the "policy decisions Congress makes through the NDAA – the substantial funds it authorizes and the direction it gives to the [DoD]" the NDAA truly does have a "global impact" (Rachel Jacobson & Matthew Ferraro, Top 5 NDAA Provisions on Energy and The Environment, LAW360 (Aug. 9, 2018)).
[26] 10 U.S.C. § 2911(e) (2006). Also, the Energy Policy Act (EPAct) of 2005 set a goal of 7.5% renewable energy consumption by 2015, and this was further extended by Executive Order 13693 to reach 25% renewable energy consumption by 2025, with an intermediate goal of 10% by FY16. The DoD did not meet the EPAct or EO 13693 goals, and in FY16, renewable energy consumption only accounted for 4.8% of DoD's total electricity consumption (Office of the Assistant Sec. of Def. for Energy, Installations, and Environment, Department of Defense Annual Energy Management and Resilience (AEMR) Report Fiscal Year 2016, U.S. DEP'T OF DEF. (Jul. 2017) 31 [hereinafter DoD FY16 AEMR]).
[27] DoD Annual Energy Management and Resilience Report (AEMRR) Fiscal Year 2017 at 28 (hereinafter DoD FY17 AEMRR).
[28] DoD FY16 AEMR at 15.
[29] *Id.* (citations omitted). The U.S. Postal Service and its nation-wide post offices comes in second to the DoD.

or between $3.5 to 4 billion.[30] At these dollar amounts, any investments in renewable energy technologies that can lead to even a small net savings are worthwhile. But more importantly, expanding new energy technologies within DoD serves the added purpose of increasing our national security by decreasing dependence on public utilities and increasing the diversity of DoD's energy portfolio.

This new energy resilience and security mandate may make achieving the DoD's renewable energy goal less likely. With increasing U.S. supplies of domestically produced natural gas and correspondingly decreasing prices,[31] the DoD is poised, and potentially supported by Congress, to make the easy decision of focusing on short-term gains in energy resiliency and security by increasing its supply and reliance on cheap fossil fuels and traditional backup generators. However, in the long run, this could be to the detriment of the long-term energy resilience and security of the DoD. It is important that the DoD find a way to incorporate renewable energy systems while simultaneously satisfying its energy resilience and security mandate.

This paper describes and analyzes the significance of the DoD's new mandate to increase the military's energy resilience and provides recommendations on how the military's energy resilience can be expanded in the future by continued incorporation of renewable energy sources. Section I describes why pursuing energy resilience and security is necessary due to the DoD's current dependence on commercially-purchased energy, the current threats to the U.S. electric grid that may affect the military, and the implications of maintaining the *status quo* for the nation's security. Section II describes recent congressional actions aimed at prioritizing energy and installation resilience and how this may undermine the DoD's ability to reach its renewable energy goals. Section III proposes why the DoD should continue to pursue its renewable energy goals and what the DoD can do now to ensure renewable energy sources are incorporated into its energy resiliency plans.

I. THE NEED FOR CONCERN – A NATION AT RISK

The Congress is right to prioritize energy resilience and security. We are a nation at risk and our energy infrastructure only increases that risk. Secretary of Defense Jim Mattis has stated that it is "now undeniable that the *homeland is no longer a sanctuary*."[32] Our adversaries, however we define them, are numerous and seek new ways to influence and affect our way of life.[33] From human-made threats from the sea, air, land, and more recently in cyberspace, to

---

[30] *Id. Cf.* OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE FOR ENERGY, INSTALLATIONS, AND ENVIRONMENT [hereinafter OSD(EI&E)], *Installation Energy (IE),* https://www.acq.osd.mil/eie/IE/FEP_index.html (last accessed Nov. 3, 2018) ("The Department spends approximately $4 billion a year on energy that powers its fixed installations.")

[31] Bradley Olson, *U.S. Becomes Net Exporter of Oil, Fuels for First Time in Decades*, WALL ST. J. (Dec. 7, 2018) at A2; see also, DEP'T OF ENERGY, *Staff Report to the Secretary on Electricity Markets and Reliability* (Aug. 2017) 124.

[32] Sec. of Def. Jim Mattis, *Summary of the 2018 National Defense Strategy of the United States of America*, (hereinafter, Nat'l Def. Strategy) U.S. DEP'T OF DEF., 3, https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf (last visited Nov. 3, 2018).

[33] How times are changing is aptly described in the *Summary of the National Defense Strategy* (2018):
"[There is] an increasingly complex global security environment, characterized by overt challenges to the free and open international order and the re-emergence of long-term, strategic competition between nations. These changes require a clear-eyed appraisal of the threats we face, acknowledgment of the changing character of warfare, and a transformation of how the Department [of Defense] conducts business."

predictions of increased effects from natural disasters, the security environment is more complex now than ever in our history.

The nation and the military have become ever more dependent on technology to run our daily lives, and the essential but often forgotten requirement is electricity. It is only when we experience a loss of power that we realize our dependence on it. For years, the DoD assumed that commercial electric power grids[34] were, and would remain, a reliable source of power.[35] The DoD only planned for infrequent, usually weather-related, short-term disruptions, and for backup power, the DoD has relied mainly upon diesel generators with short-term fuel supplies.[36] Taking the reliability of the electric supply from the commercial power grid for granted, many of the DoD's most critical assets – "those whose incapacitation or destruction would have a very serious, debilitating effect on the department's ability to fulfill its missions" [37] – rely on the commercial grid for secure, uninterrupted power.[38] It is clear now that the DoD's reliance on the commercial grid was a mistake.

The DoD has identified significant vulnerabilities to business, government, and the military due to our ever-increasing digital connectivity and reliance on the commercial electric grid.[39] Understanding the DoD's demand for energy highlights how dangerous it was for DoD to rely so fully on the commercial electric grid.

A. Understanding the DoD's Energy Demand

It is hard to understate the DoD's need for power. The DoD is the largest single energy-consumer in the United States.[40] To place this in perspective, the DoD's energy consumption surpasses the total energy use of more than one hundred nations.[41] The magnitude of the military's energy use is hardly surprising given that the DoD operates more than 500 installations

---

[34] The GAO described the U.S. commercial power grid as follows:

> "The U.S. commercial electrical power grid is a system of synchronized power providers and consumers connected by transmission and distribution lines and operated by one or more control centers. The U.S. power grid serving the contiguous 48 states is composed of three distinct power grids, or "interconnections"—the Eastern Interconnection, the Western Interconnection, and the Electric Reliability Council of Texas Interconnection. These interconnections provide power to the continental United States, Canada, and a small portion of northern Mexico."

(U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-10-147, Defense Critical Infrastructure -- Actions Needed to Improve the Identification and Management of Electrical Power Risks and Vulnerabilities to DOD Critical Assets (2009) 1).

[35] *Id.*

[36] U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-10-147, *Defense Critical Infrastructure -- Actions Needed to Improve the Identification and Management of Electrical Power Risks and Vulnerabilities to DOD Critical Assets* (2009) 1.

[37] U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-10-147, *Defense Critical Infrastructure -- Actions Needed to Improve the Identification and Management of Electrical Power Risks and Vulnerabilities to DOD Critical Assets* (2009) 37.

[38] In 2009, GAO surveyed 34 DoD assets deemed critical to the DoD. Of the 34 assets surveyed, 31 were reliant on the civilian power grid to supply their electricity needs U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-10-147, *Defense Critical Infrastructure -- Actions Needed to Improve the Identification and Management of Electrical Power Risks and Vulnerabilities to DOD Critical Assets* (2009) 34, 37).

[39] Nat'l Def. Strategy at 3.

[40] DoD FY16 AEMR at 15.

[41] Jacobson, et al., *supra,* at 7.01.

around the world with thousands of associated individual sites[42] – e.g., landing fields, training ranges, etc. – which include over 300,000 buildings.

The military is an enormous consumer of energy even though enormous strides have been made over the last three decades to reduce the military's energy consumption. Total DoD energy consumption has steadily decreased each year since 1976 as the DoD has invested in energy efficient technologies, increased energy monitoring, and conducted awareness campaigns.[43] Much of these gains have been accomplished by encouraging energy-efficient behaviors or through small insulation or lighting upgrade projects.[44] However, the DoD's ability to achieve inexpensive reductions in energy use is declining over time. The DoD expects that continued progress will require more "capital-intensive projects" with an eye towards total life-cycle savings over short-term gains.[45]

The Center for Naval Analysis (CNA), a not-for-profit, federally-funded research and development center, believes that our "nation's current energy posture is a serious and urgent threat to national security,"[46] but it also believes that the DoD can be the driver for change in advanced energy technologies that can help improve the world's energy environment.[47] The DoD and Congress have recognized the vulnerabilities the military faces as a result of its reliance on public utilities and have increased the military's investments in numerous renewable energy projects; [48] however, as of FY17, less than 9% of DoD energy is produced or procured from renewable sources.[49] Lacking alternative energy sources, the DoD is almost entirely dependent on fossil fueled generators for backup power. This dependence increases the DoD's overall level of vulnerability by providing only a one-dimensional and costly response that is entirely dependent on a ready supply of fuel.[50]

B. Cost of Power Outages to the DoD and the DoD's Contingency Plan

Power outages at military installations impose high fuels cost for emergency power generation and generally disrupt normal operations. The DoD experiences power loss more

---

[42] Office of the Under Sec. of Def. for Acquisition, Technology, and Logistics, *Department of Defense Climate-Related Risk to DoD Infrastructure Initial Vulnerability Assessment Survey (SLVAS) Report*, U.S. DEP'T OF DEF. (Jan. 2018) 13, http://www.oea.gov/file/896/download?token=v13GXIKg (last accessed Nov. 3, 2018).

[43] There have been several outlier years where DoD energy consumption increased, but the overall trend average has been a downward slope from 1976 (at over 180,000 BBtus/ft^2) to 2016 (at under 100,000 BBtus/ft^2) (see, Figure 3-5 in the FY16 AEMR at 19).

[44] DoD FY AEMR at 18.

[45] DoD FY AEMR at 18. This is an area where Congress should consider the impacts of annual energy consumption reporting. Mere reporting of consumption numbers or intensity of use focuses on a point in time instead of with an eye toward the future. With many energy decisions being made a the local installation levels, and awards been distributed to energy efficient installations, there may be a tendency for commanders to focus on no- or low-cost energy savings to the expense of more long-term energy projects.

[46] CNA Military Advisory Board, *Powering America's Defense: Energy and the Risks to National Security*, CNA (May 2009) viii, https://www.cna.org/cna_files/pdf/MAB_2-FINAL.pdf.

[47] See generally, CNA Military Advisory Board, *Advanced Energy and U.S. National Security*, CNA (Jun. 2017), https://www.cna.org/CNA_files/PDF/IRM-2017-U-015512.pdf.

[48] DoD FY16 AEMR at 34 ("In FY 2016, DoD had over 1,631 active renewable energy projects, compared to approximately 1,390 reported in FY 2015.")

[49] DoD FY17 AEMRR *supra* at 27.

[50] See generally, Ryan Baggett & Brian Simpkins, *Homeland Security and Critical Infrastructure Protection* 14 (2nd ed. 2018) (The authors describe the relationship of dependencies, vulnerability, and alternatives as the factors necessary to determine the criticality of given infrastructure.).

frequently than the civilian sector, and the frequency of power outages on DoD properties is increasing even though the DoD, by and large, receives its power from the same power grid that supplies the civilian sector.[51] The military's relative high vulnerability to power outages is mainly attributable to geography. Military installations are typically large and often located in remote areas at the end of public utility distribution lines.[52] With longer transmission lines, the chances of power disruption along the line increases, and the public utility's response time likewise increases.[53] Lastly, many military installations suffer from their own infrastructure challenges with their existing installation electrical distribution system, which is outside the control of the local utility companies.[54] A recent study from the Massachusetts Institute of Technology's Lincoln Laboratory found that "[i]n some cases, a [military installation] 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."[55] These issues create challenges unique to military installations and increase the frequency, duration, and consequently the cost of power outages to the DoD.

There are numerous costs associated with power loss on military installations. The biggest of which is the risk to the mission. The interconnected nature of military operations has allowed operational units abroad to become reliant on being able to reach back to supporting military installations for a host of operational needs. For example, U.S. Central Command, which is responsible for all military operations in the Middle East and Central and South Asia, is headquartered in Tampa, Florida. Operations halfway across the globe depend on reliable communications with a headquarters element located in the heart of the U.S. East Coast's hurricane alley. Another example is the increased reliance on unmanned aerial systems (UAS), a growing number of which are controlled worldwide from domestic military installations and rely on satellite communications with the UAS in order to be effective. These UAS are used for tactical engagements, targeting, real-time intelligence, surveillance, and command and control of deployed forces. If these assets were grounded due to unavailability of power, the risks to U.S. forces on the ground and the impacts to mission effectiveness would be great.[56]

In addition to the intangible costs of mission degradation or failure, there are financial costs to the DoD associated with power outages. Taking all financial costs into account, the DoD has reported that the financial impact to the DoD associated with utility outages is

---

[51] Jeffrey Marqusee et al., *Power Begins at Home: Assured Energy for U.S. Military Bases*, PEWTRUSTS (Jan. 12, 2017), vi, https://www.pewtrusts.org/~/media/assets/2017/01/ce_power_begins_at_home_assured_energy_for_us_military_bases.pdf (This study was conducted by Noblis, a nonprofit science, technology, and strategy organization. The study was funded by the Pew Charitable Trusts, a non-profit, non-partisan organization.).

[52] *Id.* at 15.

[53] *Id.* at 15.

[54] *Id.* at 15 (These challenges include aging infrastructure, tree maintenance and encroachment, exposed power lines, and other areas where investments in maintenance could decrease the likelihood of failure.).

[55] N. Judson et al., *Application of a Resilience Framework to Military Installations: A Methodology for Energy Resilience Business Case Decisions* (Sep. 2016) v.

[56] For example, in the Senate report accompanying the FY18 NDAA, Senate Report 115-125, 341 (Jul. 10, 2017), the Senate Armed Services Committee provides the following examples: "the committee notes that a lack of resilience caused a remotely piloted aircraft (RPA) to lose its feed during a mission, causing a terrorist target to escape. Furthermore, a deliberate power outage at Incirlik Air Base left the Air Force without a grid power supply for almost a week, significantly reducing the number of airstrikes flown in support of the Syria mission.").

approximately half a million dollars per day.[57] Equipment failures represented the cause of approximately 45% of outages in FY16, 11% were attributed to acts of nature, 2% were due to "other" causes,[58] and the remaining 42% were attributed to planned maintenance.[59] In FY16, the average duration of all utility outages was one and one-half days.[60] If required to weather a longer outage, the cost would undoubtedly be much higher due to depletion of on-site fuel reserves and the cost and time required for replenishment. For power outages effecting distribution networks (highways, railways, and pipelines) such as those caused by natural disasters, the ability to transport replacement fuel may be severely impaired and drive the price for replacement fuels higher.

The CNA predicts that a future nation-wide power outage that extended for several days or weeks would likely result in failures in civilian critical communications systems, transportation breakdowns, and degradation of essential lifesaving services.[61] These problems could lead to social unrest, looting, and increase the demands for emergency responders and public health providers – all who will be suffering through the effects of the power outage themselves.[62] In extreme circumstance, when civilian services are degraded, there's a potential for the DoD to be called upon to provide logistical support or to maintain law and order, which would only add to the potential costs to the DoD.[63]

Currently, the DoD relies heavily on fossil fuel powered generators to provide backup electric power. There are a few disadvantages to this strategy. First, there is reason to doubt the reliability of these generators. Second, they have been designed only to weather short-term outages, and thus do not have the required stockpiles of fuels needed in case of long-term outages. Lastly, generators have been designed to operate in isolation, providing electricity directly to a critical load, which in many cases does not result in the generator being used at full capacity. A more integrated design is required.

A recent study from the Massachusetts Institute of Technology's Lincoln Laboratory found that for a variety of reasons the reliability of these generators is below industry standards and may prove unreliable when needed most.[64] Generator reliance could be improved through improved maintenance and periodic testing of the equipment. But fossil-fuel-based generators still would be a costly and one-dimensional backup highly dependent on a ready supply of fossil fuels. According to the CNA, fuel reserves for back-up generators are generally designed to last

[57] DoD FY16 AEMR at 40. The report does not indicate how DoD determines this value. The DoD FY17 AEMRR reported that the cost for utility outages in FY17 totaled over $27 million, which averaged a financial loss of only $12,671 per outage day. Regardless of the daily costs, these losses are significant.

[58] E.g., vehicle accidents or operator errors.

[59] *Id.* at 40-1. Similar statistics were reported for FY17 with equipment failures representing 43%, acts of nature increasing to 15%, and other causes rising to 7% (DoD FY17 AEMRR at 33).

[60] DoD FY16 AEMR at 41.

[61] *Id.*

[62] *Id.*

[63] The Posse Comitatus Act (18 U.S.C. § 1385) prevents the DoD from engaging in police functions unless authorized by Congress. However, pursuant to the Insurrection Act (10 U.S.C. § 331-335 (2012)), as an authorized exception to the Posse Comitatus Act, the military has been used to maintain law and order when authorized by the President. The most recent example of the President's use of the Insurrection Act was in 1992, when the President ordered military members to help control rioting in the wake of the Rodney King trial verdict (Stephen Dycus, et al., National Security Law (2016) 1239).

[64] N. Judson et al., *Application of a Resilience Framework to Military Installations: A Methodology for Energy Resilience Business Case Decisions* (Sep. 2016).

only a matter of hours, or at most, a few days.[65] Moreover, the military currently deploys backup generators only to run the most critical systems, leaving other systems without power.[66] Using these backup systems comes with a price tag which includes the operating costs of the generators as well as the equipment, vehicle, and manpower costs associated with keeping these generators supplied with fuel. Compounding the issue is a finding from the Defense Science Board, which reported that "the military's backup power is inadequately sized for its mission and military bases cannot easily store sufficient fuel supplies to cope with a lengthy or widespread outage."[67] It is clear that the current system is inadequate.

C. Growing Threats to the U.S. Electric Grid

The threats to the U.S. electric grid are vast and increasing and beyond the scope of this paper to address in detail. Government organizations such as the DoD,[68] the Department of Energy,[69] the Federal Energy Regulatory Commission,[70] and the Government Accountability Office,[71] as well as other organizations such as the CNA,[72] Counsel on Foreign Relations,[73] and the National Academies of Sciences, Engineering, and Medicine[74] have outlined the numerous threats to the U.S. electric grid. The CNA has been writing on the vulnerabilities to the U.S. electric grid and its threats to national security for nearly a decade.[75] In the 2016 book "The Grid," author Gretchen Bakke describes the grid as "an old, beat-up, pothole-riddled, one-lane dirt road." [76] She says the "grid is worn down, it's patched up, and every hoped-for improvement is expensive and bureaucratically bemired."[77] She says that the grid we have today is one designed for a century's old technologies and in desperate need of replacement.[78]

---

[65] CNA Military Advisory Board, *National Security and Assured U.S. Electrical Power* (Nov. 2015) 5, https://www.cna.org/CNA_files/PDF/National-Security-Assured-Electrical-Power.pdf.
[66] *Id.*
[67] National Security and Assured U.S. Electrical Power, supra, at 9.
[68] Deputy Sec. of Defense (Installation Energy), Dep't of Def., Memorandum, *Energy Resilience Operations, Maintenance, and Testing Guidance* (Mar. 17, 2017). In one GAO study, the GAO quotes the Defense Science Board which describes the grid as increasingly fragile and vulnerable (U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-10-147, *Defense Critical Infrastructure -- Actions Needed to Improve the Identification and Management of Electrical Power Risks and Vulnerabilities to DOD Critical Assets* (2009) 37).
[69] Sec. of Energy Rick Perry cover letter to the *Staff Report to the Secretary on Electricity Markets and Reliability* (Aug. 23, 2017).
[70] *National Security and Assured U.S. Electrical Power*, *supra*, at 6 (citations omitted) (quoting a FERC study addressing how a loss of only nine electricity substations could cause nationwide or regional outages lasting for weeks or possibility even months, due to a lack of ready replacements and the high costs of production.
[71] U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-10-147, *Defense Critical Infrastructure -- Actions Needed to Improve the Identification and Management of Electrical Power Risks and Vulnerabilities to DOD Critical Assets* (2009).
[72] CNA Military Advisory Board, *Powering America's Defense: Energy and the Risks to National Security*, CNA (May 2009) viii, https://www.cna.org/cna_files/pdf/MAB_2-FINAL.pdf.
[73] Robert Knake, *Contingency Planning Memorandum No. 31: A Cyber Attack on the U.S. Power Grid*, COUNCIL ON FOREIGN RELATIONS (Apr. 2017) 1, https://cfrd8-files.cfr.org/sites/default/files/pdf/2017/03/ContingencyPlanningMemo31_Knake.pdf.
[74] National Academies of Sciences, *Engineering, and Medicine, Enhancing the Resilience of the Nation's Electricity System* 18 (2017).
[75] See, e.g., CNA Military Advisory Board, *Powering America's Defense: Energy and the Risks to National Security*, CNA (May 2009) viii, https://www.cna.org/cna_files/pdf/MAB_2-FINAL.pdf.
[76] Gretchen Bakke, *The Grid* (2016) xiv.
[77] *Id.*
[78] *Id.* at xvi.

The long-term degradation of the commercial electric grid already provides an unacceptable risk to the DoD and our national security. Compounding these risks are the increasing risk posed from physical attacks,[79] cyber-attacks,[80] and the increasing frequency and severity of natural disasters.[81] A Senate report accompanying the FY2018 NDAA noted that the

[79] The most dangerous threats to the U.S. electric grid are those posed by our adversaries – those who intend to inflict harm on against the United States and its citizens. From physical attacks to cyber-attacks, the effects of attacks on the U.S. electric grid could be catastrophic. In 2013, a sniper attack on a California substation disabled 17 transformers and caused $15 million in damages (National Security and Assured U.S. Electrical Power, supra, at 7.). The perpetrators were never caught (Id.). In 2016, the Wall Street Journal reported, based on that of a survey of 1000 substations throughout in 14 states, roughly that about half of these substations were protected only by a simple padlock (Rebecca Smith, Power Grid Left Exposed to Sabotage – Recent attacks show thousands of electrical substations lack defenses, WALL ST. J., Jul. 14, 2016, at A1.).

[80] The rise of cyber warfare and the ability of individual bad actors to attack the electric power grid anonymously via the internet represents another serious threat. These attacks can be launched in real time or by implanting malware that can be activated at a later time (National Academies of Sciences, supra, at 52-4.). What sets cyber-attacks apart from the other threats to the U.S. grid discussed above, is that the affects could be more widely dispersed geographically than effects from natural hazards or physical attacks. In addition, physical attacks require physical presence on or near the grid, and a wide-spread physical attack would require a coordinated and somewhat synchronized effort. By contrast, a cyber-attack may require substantial planning, but it can be conducted completely within cyberspace.

In March 2018, the New York Times reported that it was not a question of whether Russia had the capability of shutting down the U.S. electric grid, but only of whether Russia had the political willpower to do it (Nicole Perlroth & David Sanger, Cyberattacks Put Russian Fingers on the Switch at Power Plants, U.S. Says, N.Y. TIMES, Mar. 15, 2018 (Mr. Eric Chien, security technology director at digital security firm Symantec stated that, "[the Russians] have the ability to shut the power off. All that's missing is some political motivation.")). On the same day as the New York Times report, the Department of Homeland Security (DHS) released a joint technical alert confirming that it had information that the Russian government was targeting the U.S. government as well as private entities in the "energy, nuclear, commercial facilities, water, aviation, and critical manufacturing sectors" (Dep't of Homeland Security, U.S. Computer Emergency Readiness Team, Alert (TA18-074A): Russian Government Cyber Activity Targeting Energy and Other Critical Infrastructure Sectors (Mar. 16, 2018), https://www.us-cert.gov/ncas/alerts/TA18-074A.). The alert further confirmed that the Russian government had staged malware and gained access into energy sector networks (Id.)

[81] Nature is and will continue to be a threat to the U.S. electric grid. Mother nature produces a multitude of threats to the U.S. electric grid, often without any notice. Threats include drought (effecting hydro-electric power production), earthquakes, volcanoes, flooding, extreme temperatures, wildfires, landslides, sinkholes, lightning, winter storms, tornadoes, tsunamis, wild animals, and space weather. (*See generally*, Baggett & Simpkins, *supra*, at 148-9; Rachel Lundberg, *Snake Causes Power Outage in Huntersville*, WCNC (May 23, 2018), https://www.wcnc.com/article/news/snake-causes-power-outage-in-huntersville/275-557572382 (resulting in a nearly 10-hour outage)). With this veritable cornucopia of natural risks, it is not surprising that severe weather events are the leading cause of power outages (Marqusee, supra, at 3.). In 2013, the White House reported 87% of power outages between 2003 and 2012 were caused by severe weather events (Marqusee, supra, at 3 (citing, the Executive Office of the President, Economic Benefits of Increasing Electric Grid Resilience to Weather Outages, August 2013, p. 8.)) The U.S. Department of Energy reports that the number of severe weather events and their associated costs are increasing and are expected to increase in the future (U.S. Department of Energy, Quadrennial Energy Review: First Installment, ENERGY.GOV (Apr. 2015) 2-6, https://www.energy.gov/policy/downloads/quadrennial-energy-review-first-installment (last accessed Nov. 4, 2018)). In September 2018, hurricane Florence hit South-eastern North Carolina, home of the largest Marine Corps base on the East Coast and largest Army base in the world and caused widespread damage and power outages that lasted weeks and forced the evacuation of thousands of Marines, Soldiers, and their families. Just weeks later, hurricane Michael struck the Gulf coast forcing Naval Support Activity Panama City to shut down from October 10, when the hurricane made landfall, to November 1, when the installation finally issued an "all clear" order, and returned the base to normal operations (Mark D. Faram, In Michael's Wake, Navy Digs Out in Panama City, NAVYTIMES (Nov. 6, 2018), www.navytimes.com/news/your-navy/2018/11/06/in-michaels-wake-navy-digs-out-in-panama-city.). With over 1,700 military installations residing in coastal regions, the threats posed by these

DoD "continues to experience multiple utility grid outages every year" which have negative impacts on military readiness.[82] The report continued by highlighting the Senate Armed Services Committee's (SASC) concern of the DoD's vulnerability to physical and cyber-attacks, and severe weather events, which it believes "threaten[s] the [DoD's] ability to recover from multi-day utility disruptions on its installations."[83] The SASC stated that by "improving energy resilience," the DoD will "decrease utility disruptions and grid outages that negatively impact operations and compromise readiness."[84] These risks have forced a shift in mindset from one of energy conservation to one of energy resilience and security. The *status quo* is no longer acceptable.

II. CONGRESS SPEAKS – A SHIFT FROM CONSERVATION TO RESILIENCE

Since 2005 the mindset has been one of cost savings and energy conservation aimed at operating in fiscally-constrained environments, reducing the DoD's electric bill, and potentially reducing the DoD's environmental impacts. These goals were important and have served their purpose and saved the DoD millions of dollars in energy costs and spurred investment in clean, renewable energy projects. However, these projects focused on conservation and gave very little thought, if any, to energy security and resilience. A 2016 GAO study highlights this view.[85] The report shows how the DoD and the GAO continue to focus on traditional cost-benefit analysis and return on investment when evaluating renewable energy alternatives.[86] Much time in the report is spent discussing the costs of renewable energy initiatives and the failure of DoD to adequately evaluate the energy savings actually achieved after a project is completed, versus what was initially projected during the cost-benefit / contracting stages.[87] When the DoD and GAO look at renewable energy alternatives simply through the lens of cost-benefit analysis, they fail to analyze and value the security implications of the project.

In March 2017, the Deputy Assistant Secretary of Defense for Installation Energy announced that the DoD had reviewed the ability of installations to prepare for and recover from energy disruptions, and stated that the DoD had found there to be an "unacceptable risk in the operations, maintenance, and testing . . . of [the DoD's] energy generation systems and infrastructure, and the critical mission which they support."[88] Congress listened and took action.

---

storms can have huge impacts on military readiness (Neela Banerjee, Sea Level Rise Damaging More U.S. Bases, Former Top Military Brass Warn, INSIDE CLIMATE NEWS (Feb. 26, 2018), https://insideclimatenews.org/news/26022018/sea-level-rise-military-bases-damaged-national-security-risk-report-admirals-generals). Whether this is associated with climate change, the increasing populations in coastal cities, or simply aging infrastructure, the bottom line is that severe weather events are becoming more deadly and costly than ever before (See e.g., Kara Dapena, The Rising Cost of Hurricanes, WALL ST. J. (Sep. 29, 2018) https://www.wsj.com/articles/the-rising-costs-of-hurricanes-1538222400).

[82] Senate Report 115-125, *supra*, at 100.

[83] Senate Report 115-125, *supra*, at 100.

[84] Senate Report 115-125, *supra*, at 100.

[85] U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-16-162, *Energy Conservation Investment Program Needs Improved Reporting, Measurement, and Guidance* (2016).

[86] See e.g., U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-16-162, *Energy Conservation Investment Program Needs Improved Reporting, Measurement, and Guidance* (2016)

[87] U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-16-162, *Energy Conservation Investment Program Needs Improved Reporting, Measurement, and Guidance* (2016).

[88] Deputy Sec. of Defense (Installation Energy), Dep't of Def., Memorandum, *Energy Resilience Operations, Maintenance, and Testing Guidance* (Mar. 17, 2017).

With the passage of the FY18 NDAA, Congress has mandated that the SecDef "ensure the readiness of the armed forces for their military missions by pursuing energy security and energy resilience."[89] This mandate effectively equates energy security and resilience with military readiness, which puts the DoD's new energy policy on par with other military readiness priorities such as training, personnel management, weapons system procurement, research and development, etc. The DoD should always consider whether a given expenditure in these areas is prudent – that the DoD is getting its bang for its buck – but it traditionally sees these costs as a necessary part of maintaining and improving readiness and security. The question now is what the impact of this new focus will be. The Senate Report accompanying the FY18 NDAA and the DoD's apparent response help to shed some light on the future of the DoD's energy posture.

A Senate report accompanying the FY18 NDAA, after noting its concerns with the DoD's lack of energy security and resilience, highlighted the numerous authorities previously passed by Congress that could aid the DoD in its efforts, and encouraged the DoD to pursue new microgrid technologies which the SASC described as "fuel agnostic,"[90] and thus would allow the DoD to experiment with numerous distributed power generation techniques including "fossil fuels, fuel cells, batteries, . . . and renewables."[91] However, the Energy Policy Act (EPAct) of 2005, and the DoD and Department of Energy's implementing policies, limit the DoD to only pursue renewable energy initiatives that are cost-effective relative to the *status quo*.[92] What has resulted in the last year, is a focus by the DoD on fuel-agnostic resiliency efforts. Three times in the DoD's most recent Annual Energy Management and Resilience Report does the DoD parrot the Senate report's language claiming to be fuel agnostic, stating twice that,

> "[the] DoD is agnostic toward any specific technologies and practices that are employed to achieve resilience. Ultimately, energy resilience is a binary measure; either missions have the energy that is required, when and where it is needed, or they do not."

It is possible that the DoD's new-found agnosticism or indifference coupled with a focus on cost-effectiveness will put DoD on the path of embracing more standard fossil-fuel powered backup systems, without first considering the potential advantages of other renewable options. Just recently the Wall Street Journal reported that for the first time in decades the U.S. is a net exporter of fuel,[93] and a 2017 Department of Energy report concluded that "there appears to be little near-term risk that natural gas prices will rise significantly and thereby reduce electricity affordability."[94] In addition, it is reported that the Trump administration may be considering bailing out civilian coal and nuclear power plants "in order to make the electricity supply to military bases more reliable, which would only drive prices further down.[95] The focus on being

---

[89] FY18 NDAA § 2831, codified at 10 U.S.C. § 2911(a).
[90] What I think the SASC really is expressing is fuel "indifference."
[91] Senate Report 115-125, *supra*, at 100.
[92] U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-10-104, Defense Infrastructure – DOD Needs to Take Actions to Address Challenges in Meeting Federal Renewable Energy Goals (2009) 19.
[93] Bradley Olson, U.S. Becomes Net Exporter of Oil, Fuels for First Time in Decades, WALL ST. J. (Dec. 7, 2018) at A2.
[94] DEP'T OF ENERGY, Staff Report to the Secretary on Electricity Markets and Reliability (Aug. 2017) 124.
[95] Philip Rossetti, *To Improve Energy Security of Military Bases, Use Less Civilian Power – Not More,* AMERICAACTIONFORUM.ORG (Jul. 20, 2018) https://www.americanactionforum.org/research/to-improve-energy-security-of-military-bases-use-less-civilian-power-not-more/.

fuel agnostic, cost-effective, and the ready supply of cheap fuel, makes it hard for renewable energy to compete. The DoD has failed to achieve several interim renewable energy goals established by Congress in 2005 and has suffered little to no repercussions. Considering Congress' new mandate to DoD, it is understandable that DoD's focus may begin to shift towards satisfying this mandate while ignoring these long-term renewable energy goals. However, there may be a way to achieve both, and Congress has given DoD the authority to do so.

III. THE DOD AS A DRIVER FOR CHANGE – OPPORTUNITIES FOR RENEWABLE ENERGY PRODUCTION & WHAT DOD CAN DO NOW

Throughout history, the DoD has been a driver for innovation. Aimed at improving national security, countering new threats, or maintaining an edge on our adversaries, technology first pioneered by the DoD has had huge effects on the civilian sector. From duct tape to drones, to radar and global positioning systems, the DoD's mission needs have provided the demand and funding necessary to spur technological innovation in almost every area.[96] The same can be true in the area of renewable energy and energy resilience projects. In the past two years, Congress has given the DoD the authority it needs to continue developments in these areas, but DoD must act now.

A. Energy Resilience Metrics and Energy Resilience Plans

For over a decade, the DoD has been required by acts of Congress, reinforced by Presidential Executive Orders, to reduce its use of energy on military installations and increase its use or renewable energy.[97] The DoD has invested in energy efficient technologies, energy monitoring programs, and awareness campaigns. Consequently, the DoD's energy use has steadily declined in recent years.[98]

While these mandates will help achieve an important environmental goal, they set up a potentially serious conflict with Congress's new-found enthusiasm for promoting military energy resiliency. The problem with these past initiatives, is that they do not take energy resiliency into account. By not having an overarching theme of energy security and resiliency, these efforts are operating in a vacuum, instead of as part of an integrated unit. As one commentator put it, "[t]he more heavily invested we are in efficiency, the more difficult and costly it is to reform towards resiliency."[99] We cannot afford to focus only on energy consumption or percentage of renewable energy, if it produces a less reliable and resilient system. The answer is not to simply increase energy efficiency and renewable energy sources. Undoubtedly, these are both part of the solution, but not the entire solution.

---

[96] Adrian Willings, *27 Military Technologies that Changed Civilian Life*, POCKET-LINT.COM (Feb. 2, 2018), https://www.pocket-lint.com/gadgets/news/143526-27-military-technologies-that-changed-civilian-life.

[97] See, e.g., Exec. Order No. 13423, 72 Fed. Reg. 3913 (Jan. 24, 2017) (requiring 3% annual energy reductions or 30% total energy reduction by the end of FY15); the Energy Independence and Security Act of 2007, Pub. L. No. 110-140, 121 Stat. 1492, 1607 (2007) (which modified the National Energy Conservation Policy Act and set to reduce energy intensity by 30% by FY15).

[98] DoD FY16 AEMR, *supra*, at 17.

[99] Dr. Scott Thomas & David Kerner, U.S. Army War College, Strategic Studies Institute, *Defense Energy Resilience: Lessons from Ecology* (Aug. 2010).

In the FY19 NDAA, Congress gave the SecDef the authority to "establish metrics and standards for the assessment of energy resilience" and the authority to create energy resiliency plans for military installations.[100] These are important tools for the DoD. In crafting these metrics, the DoD can account for some of the advantages that renewable energy sources bring to the table, and by factoring these advantages into the equation it can encourage their incorporation into an installation's energy resiliency plan. Energy resilience must be a metric that the DoD can quantify and factor into every decision related to energy use and production. Elements establishing this metric should include the following:

a. a distributed energy factor – a measurement of the variety of energy sources available to the installation;
b. a dependency factor – a measurement indicative of whether the energy production is reliant on outside sources such as fossil fuel delivery mechanisms, sunlight, wind availability, etc.;
c. a distribution factor – a measurement of how lengthy the distribution lines are and what level of control the DoD has over them;
d. a production factor – indicating the amount of energy DoD is capable of producing on the installation at any given time;
e. a storage factor – indicating the level of energy storage available to an installation; and finally,
f. a control factor – indicating the amount of control the DoD has over the electric generation, either physically or contractually (with independence from the commercial grid given more favorable consideration).

These factors should form the basis of a resilience metric that, if balanced, should result in development of renewable energy, not simply for renewable energy's sake, but to increase the overall reliability and resiliency of the entire system.

Certain renewable energy technologies such as wind and solar are rightly criticized for their intermittency and therefore alone may not always provide a reliable source of power; however, if properly integrated into the military's backup systems, it does provide diversity which increases redundancies and which can be completely untethered from the commercial infrastructure.[101] With nearly 28 million acres of land, DoD lands are well-suited to support solar, wind, and other forms of renewable energy projects.[102] Solar and wind are not dependent upon functioning highways or pipelines for fuel, and as long as the wind is blowing and the sun is shining, they could provide critical power when other fossil-fuel powered systems fail, or provide fuel savings when renewable energy is abundant and generators can be powered down. Some renewable capability helps fulfil then-General Mattis' famous request to "unleash us from the tether of fuel."[103]

---

[100] FY19 NDAA § 312(a)(2), to be codified at 10 U.S.C. § 2911(b)(1).
[101] Richard Heinberg and David Fridley, Our Renewable Future, (2016) 51.
[102] Marqusee, *supra* at 25 (citing to a 2012 DoD survey which indicated that four percent of DoD lands that were prime for solar development could produce the equivalent output of seven nuclear power plants). DoD already operates a geothermal plant in Nevada that provides power to the installation and the local civilian populace. The renewable solutions will depend on the specifics features of each area. There is no one-size-fits-all approach.
[103] DEP'T OF DEF., News Briefing with Deputy Secretary Lynn and Assistant Secretary Burke from the Pentagon on the DOD Operational Energy Strategy (June 14, 2011).

A 2017 report from the National Academies of Science, Engineering, and Medicine cautioned against equating reliability with resiliency.[104] The report advocates for distributed power generation from a "diverse set" of sources in order to respond to "wide variety of hazards."[105] Renewable energy sources are one way to provide an increased level of energy diversity, and that diversity can increase our resilience even if it cannot be relied upon 24 hours a day. As Secretary Mattis stated, "[i]n this environment, there can be no complacency – we must make difficult choices and prioritize what is most important" in order to "field a lethal, resilient, and rapidly adapting Joint Force."[106] Any new source of energy or backup energy device should be viewed as part of the entire system, not simply as a standalone entity. Each system should improve upon one of the factors outlined above, or its utility to the system should be questioned and highly scrutinized.

When striving toward "use" goals for renewable energy, Congress has prioritized a type of energy, but did not evaluate how resilient these energy sources would be. For instance, not all renewable energy is alike, even if they each count the same toward reaching Congress' renewable energy goals. Solar arrays may prove more resilient to storms than wind turbines, and on-site generation may prove more resilient than renewable energy produced off installation. Biofuels may be easily accessible in one region, and too costly to procure in another. It is not that any of these systems or initiatives are bad, it is simply that there must be an overarching strategy to incorporate these energy initiatives into a mutually beneficial and supporting network.

The SecDef should utilize his new statutory authority and require each military installation to establish comprehensive energy resilience plans. These plans should be specific to each military installation or region based on the resources available in those areas. These plans should identify areas compatible with renewable energy facilities or on-site fuel storage. They should evaluate and rank order each mission critical facility and the power it needs to stay fully mission capable. The plans should then quantify what the current power deficits to the installation are if primary power sources were compromised. By identifying these energy deficits, the DoD can then encourage third-party investment, creative partnerships, and new energy generation techniques that the DoD can use to reduce these power deficits. With 28 million acres of land, much of it compatible with renewable energy development, a piecemeal approach without an overarching plan is doomed to be ineffectual at best.

B. Change the Cost-Benefit Analysis

Energy resilience metrics and plans won't be effective without first changing the way the DoD analyzes energy spending. The DoD must utilize its new discretionary authorities provided in the FY18 NDAA to place an increased value or weight on renewable energy sources when conducting its cost-benefit analysis required when making energy procurement decisions. A traditional cost-benefit analysis simply doesn't work because valuing the benefits to readiness is not possible. For example, how much is a new ballistic missile defense system worth? We know how much it will cost, but if it works, its value is more than dollars and cents. It provides a capability that wasn't there before, may increase national security, save lives, or deter aggression. If energy resilience and security are viewed in this light, paying higher costs for the

[104] National Academies of Sciences, Engineering, and Medicine, Enhancing the Resilience of the Nation's Electricity System (2017) 1.
[105] *Id.*
[106] Sec. of Def. Jim Mattis, *supra*, at 1.

development of on-site production of renewable energy makes more sense. Even if a given project will cost more than it saves, what effect will it have on enhancing the energy resilience and security of an installation? This is the question that needs to be asked.

One way to account for these sorts of intangible benefits is to place a value on energy resilience and security. The FY18 NDAA authorized the inclusion of both energy security and energy resilience considerations, "including the benefits of on-site generation that reduce or avoid the cost of backup power, as factors in the cost-benefit analysis for procurement of energy."[107] One obvious consideration regarding renewable energy is that once constructed it produces energy for free. Another consideration is that they do not require refueling. The cost of fossil-fuel powered backup power, even in a cheap natural gas market, is still a significant cost to the DoD. Accordingly, if properly weighted to account for their independence and free energy production, renewable projects may prove cost beneficial.

If a revised-cost benefit analysis is not enough to make a renewable energy project beneficial, the FY18 NDAA further permits the DoD to give "favorable consideration to [renewable energy] projects that provide power directly to a military facility or into the installation electrical distribution network.[108] Some criticize this approach as resulting in the DoD paying a premium for renewable energy projects.[109] This may be true, but it may also spur innovation and further developments in the renewable energy industry – benefits that could redound to the military and the civilian community – and at the same time would help to improve energy security and resilience on military installations.

C. Get off the Grid, but Stay Connected and Encourage Third-Party Partnerships

If you add energy resilience and security to the analysis and not just focus on cost-benefits, the is conclusion is that the DoD must get off the national grid, even if only on an as needed basis. The DoD is almost entirely reliant on power from the national grid and the risks are simply too high. Improving the national grid should continue be a U.S. priority, but the DoD cannot wait for the Nation to act when other options are available. Considering that the DoD has historically been a driver for technological innovation, it may be better to say that the Nation cannot wait any longer for the DoD to act. The time is now. The solutions pioneered and tested by the DoD can succeed and fail on a small scale and be the test bed that the Nation needs to move forward at improving the national grid.

In 2015, the CNA described the "grid of the future" as one where electricity is "produced closer to consumers, from a wide variety of sources, and stored or shared until needed."[110] The DoD should consider implementing micro-grid technology, i.e., an installation-level grid, that can feed off the national grid, but is capable of running independently. As the Senate report to the FY18 NDAA acknowledged, these grids are "fuel agnostic" and can be designed to receive power from any source.[111] This includes the capability to accept energy from new and emerging technologies.[112] The system maximizes source flexibility. Once such grids are established,

---

[107] FY18 NDAA § 2831, 131 Stat. at 1858, to be codified at 10 U.S.C. § 2911(b)(4), as modified by the FY19 NDAA.
[108] FY18 NDAA § 2831, 131 Stat. at 1858, to be codified at 10 U.S.C. § 2911(b)(5), as modified by the FY19 NDAA.
[109] Marquse*e*, *supra* at ix.
[110] National Security and Assured U.S. Electrical Power, *supra*, at 1.
[111] Senate Report 115-125, *supra*, at 100.
[112] National Security and Assured U.S. Electrical Power, *supra*, at 2.

various energy projects can be plugged into the microgrid – turning the host of individual energy sources into one cohesive unit. To the extent installation production exceeds demand, the energy can be sold back to the commercial grid. This possibility may encourage third-party financing[113] of new renewable energy projects.

With the passage of the FY18 NDAA, for the first time,[114] Congress requires the DoD to consider third-party financing to address installation energy needs and to lower costs of new energy projects.[115] This is consistent with the DoD's current National Defense Strategy which states that, "[w]hen we pool resources and share responsibility for our common defense, our security burden becomes lighter."[116] Energy agreements can be structured to provide energy predominantly to the commercial grid, but be designed to default energy toward the installation in case of a regional outage or a spike in installation-energy demands. Currently, the DoD uses Energy Enhanced Use Leases to allow third parties to generate energy on DoD lands in exchange for in-kind payments.[117] These payments can include the right for DoD to divert or use energy, such as in a time of emergency.[118] In terms of increasing military installation resiliency by having the right to divert power, but providing most power directly to the local grid, the arrangement is truly a win-win.

In addition to allowing for third-party electric generation projects to the micro-grid, all installation emergency backup systems could support the needs of the entire micro-grid instead of being dedicated to a specific facility. This would allow for the installation to tap the entire backup generation capacity of the installation, and prioritize power to the current needs of the system. A recent report produced on behalf of the Pew Charitable Trust indicated that the use of generators in support of a micro-grid results in a nearly 80% savings when compared to building-tied standalone generators.[119] If this report is correct, the DoD may already have the backup electric generation capability necessary to increase energy resilience now, but simply lacks the grid infrastructure necessary to unlock this potential.

A critical component to implementing a micro-grid, is including the capability to store excess energy. This would also increase the efficacy of renewable energy technologies like wind

---

[113] One mechanism for third-party financing that has been on the books for some time is energy savings performance contracts (ESPCs). ESPCs are governed by 10 U.S.C. § 2913 and 42 U.S.C. § 8287 and are designed to accelerate the contracting process while reducing the administrative costs and effort to the DoD. For example, under a simple ESPC, a third-party contractor agrees to finance the up-front costs of a desired energy improvement, such as energy efficient lighting upgrades. The DoD then agrees to repay the third-party contractor from the annual savings that results from having lower utility bills.

In its report accompanying the FY2018 NDAA, the SASC stated that it "recognizes the efforts by the DoD to use third-party financing, such as [ESPCs], to provide cost-effective efficiency improvements to military installations," and that the "committee is strongly supportive of these efforts by the DoD and strongly encourages the use of these contracts and other third-party financing methods to improve energy infrastructure, resilience, and facilities important to the mission on military installations" (Senate Report 115-125, supra, at 106). Additionally, in the FY 2018 NDAA, Congress expanded the DoD's authority to accept "in-kind" contributions for utility services that promote the DoD's energy resilience (FY18 NDAA § 2835, codified at 10 U.S.C. § 2667(c)(1)(D)).

[114] Jacobson, *supra*, at 7.01 (the author states that the FY18 NDAA "directs DoD to consider for the first-time opportunities to use financing from third parties to address installation energy needs.") There has been authority to utilize third-party financing for some time now, but it was never required to be considered when making purchasing decisions as it is now.

[115] FY18 NDAA § 2831, 131 Stat. at 1857, codified at 10 U.S.C. § 2911(e)(13).

[116] Nat'l Def. Strategy at 8.

[117] 10 U.S.C. § 2667 (2012).

[118] See DoD FY16 AEMR, *supra*, at 34.

[119] Marqusee et al., *supra*, at 16-21.

and solar which often produce energy out of step with demand.[120] Battery storage technologies are becoming more efficient and less expensive every year. We see it with practically every new smart phone that hits the streets. They are smaller, more powerful, and charge more quickly than ever before. Having some electricity storage capacity would allow the DoD to fully tap the energy produced through renewable fuels, especially intermittent energy sources such as solar and wind, by being able to capture energy and use it to defray costs during peak energy hours, sell it back to the local grid when needed, or to provide a ready reserve of power when emergency power is needed. As the DoD continues to transition to electric vehicles, these vehicles could potentially become part of the storage capacity of the grid, especially during holidays and on weekends when use will be at its lowest.

The point of a micro-grid is to see every energy producer or storage device as a potential source for consumption in order to maximize resiliency and increase efficiency. Micro-grids, coupled with on-site storage capacities, regional/installation-level planning, and energy resiliency metrics, can produce an energy grid that operates at peak performance at all times and eliminates waste, redundancies, and maximizes flexibility.

CONCLUSION

The risks to the U.S. electric grid are many and growing. With international and domestic terrorism, cyber warfare, and the increasing frequency and devastation of natural disasters, the U.S. homeland can no longer be seen as a sanctuary. National security requires the U.S. to prioritize energy resilience and security, and the DoD is the organization to lead the charge. Congress sees this as a readiness issue and has mandated that the SecDef take steps now to pursue energy resilience and security. Congress has also directed the DoD to continue to pursue renewable energy goals to help conserve energy and promote clean energy initiatives. It is possible that these two approaches may be at odds, but Congress has given the DoD the tools it needs to achieve both. It would be short-sighted to pursue energy resilience and security without accounting for the role renewable energy can have in enhancing our resilience and security, while benefiting both the military and civilian communities.

The country must be more deliberate in its approach to energy resilience and security, and realize that the problem affects everyone, and threatens to disrupt our American Way of Life. Renewable energy should play a part of this solution, and blind adherence to traditional cost-benefit analysis without factoring in the unique benefits and diversity gained through use of renewable energy would be a mistake. This approach would continue to prioritize fossil-fuel based resources over renewable resources to the determinant of our national security. The DoD must experiment with micro-grid technology in order to break its dependence on the commercial grid and pioneer these technologies for the rest of the country. The DoD must plan, make hard decisions, and force the changes necessary to effect lasting and positive change, and put the DoD on a better energy footing. The American people need to be ready to support this effort, as the entire Nation's security may very well hang in the balance. Former Energy Secretary Steven Chu stated that, "The Stone Age did not end because we ran out of stones; we transitioned to better solutions."[121] The time to transition is now.

---

[120] Heinberg, *supra* at 53

[121] Sec. Steven Chu, Dep't of Energy, *Letter from Secretary Steven Chu to Energy Department Employees*, ENERGY.GOV (Feb. 1, 2013), https://www.energy.gov/articles/letter-secretary-steven-chu-energy-department-employees (paraphrasing former Saudi oil minister Sheikh Yamani).