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Energy, Installations, and Environment

Department of Defense

Annual Energy Management and

Resilience Report (AEMRR)

Fiscal Year 2017

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1. Introduction

The chief priority of the Department of Defense (DoD) energy policy is to ensure the mission readiness of the armed forces by pursuing energy security and energy resilience. In today's technology-dependent environment, energy is inextricably combined with the Department's missions, from the directly employed weapons systems to the installations and systems that support missions around the globe. In this environment, energy resilience, which enables the capabilities of weapons platforms, facilities, and equipment, is a critical investment that must be part of the Department's research, acquisition, operations, and sustainment conversations.

An important opportunity exists for the Department to improve its energy resilience on its fixed installations, as the Department's 500 installations worldwide, comprising nearly 300,000 buildings, account for nearly 30 percent of DoD's total energy use[1]. Aligning installation energy requirements, agnostic of specific technologies or practices, directly to mission assurance requirements is the Department's key opportunity to improve energy resilience. Energy resilience, in accordance with section 101(e) of title 10, United States Code (U.S.C.), is "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 task critical assets and other mission essential operations related to readiness, and to execute or rapidly reestablish mission essential requirements." Increasing efficiencies, lowering costs, and enhancing backup power options bolsters energy resilience when implemented as part of a comprehensive strategy rather than as disparate efforts to meet specific goals for the sake of the goals themselves. The Department will ensure energy resilience and reliability for critical missions while treating installation energy as a force multiplier in support of military readiness.

Accurate measurement of installation energy augments these principles allowing DoD to monitor and maintain an aggressive pace toward its larger energy objectives. To that end, this Annual Energy Management and Resilience Report (AEMRR) details the Department's Fiscal Year (FY) 2017 performance toward achieving greater energy resilience by leveraging objectives in energy efficiency, demand reduction, and energy supply expansion on fixed installations.

[1] Installation energy includes energy needed to power fixed installations and enduring locations as well as non-tactical vehicles (NTVs), whereas operational energy is the energy required for training, moving, and sustaining military forces and weapons platforms for military operations and training—including energy used by tactical power systems and generators at non-enduring locations.

Figure 1-1:FY 2017 DoD Progress Toward Installation Energy and Water Goals

	Reduce Facility Energy Intensity (Total facility energy consumed/Total GSF of facility space) EO 13693: -2.5% annually to -25% by FY25 (Baseline Year FY15)	Army: - 9.6% Navy: - 5.0% USMC: - 9.8% Air Force: - 4.6%	DoD: - 6.4% (Goal: - 5.0%)
	Consume More Electric Energy From Renewable Sources (Total RE consumed/Total facility electricity consumed) EO 13693: 10% (FY16-17), +2% per year (FY18-25), 30% by FY25	Army: 8.4% Navy: 2.7% USMC: 10.5% Air Force: 6.7%	DoD: 5.9% (Goal: 10%)
	Produce or Procure More Energy From Clean Sources (Total RE + Alternative energy/Total facility energy consumed) EO 13693: 10% (FY16-17), +1.5% per year (FY18-25), 25% by FY25	Army: 7.2% Navy: 16.2% USMC: 10.8% Air Force: 5.9%	DoD: 15.8% (Goal: 10%)
	Reduce Potable Water Intensity (Total potable water consumed/Total GSF of facility space) EO 13693: -2% per year (FY08-25), -36% by FY25 (Baseline year FY07)	Army: -32.0% Navy: -18.1% USMC: -39.6% Air Force: -24.1%	DoD: -26.9% (Goal: -20%)

DoD reports on its annual installation energy performance in the FY 2017 AEMRR.[2] Table 1-1 summarizes the Department's progress toward its FY 2017 energy goals[3]; Appendix D presents the Department's energy-related performance metrics in greater detail. As shown, although DoD fell short of its FY 2017 goal for renewable energy, it exceeded its energy use intensity (EUI) reduction goal and continued to exceed its goals for potable water intensity and petroleum consumption reduction[4].

The FY 2017 AEMRR is compiled based upon the following mandates (Appendix B):

- Section 548 of the National Energy Conservation Policy Act (NECPA) of 1978 (section 8258 of title 42, U.S.C.) which requires Federal agencies to describe their energy management activities;

- Section 2925 of title 10, U.S.C., which requires DoD to submit to Congress an AEMRR describing its installation energy activities;

- Section 2911(d) of title 10, U.S.C., which requires DoD to establish energy performance goals for transportation systems, support systems, utilities, and infrastructure and facilities.

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[2] This report includes the installation energy activities of the Air Force, Army, Navy, and Marine Corps, and the following Defense Agencies: Defense Contract Management Agency (DCMA); Defense Commissary Agency (DeCA); Defense Finance and Accounting Service (DFAS); Defense Intelligence Agency (DIA); Defense Logistics Agency (DLA); Missile Defense Agency (MDA); National Geospatial-Intelligence Agency (NGA); National Reconnaissance Office (NRO); National Security Agency (NSA); and Washington Headquarters Services (WHS).

[3] Executive Order (E.O.) 13693 was revoked and replaced on May 17, 2018; however, since the E.O. was in effect during FY 2017, this report will reflect DoD's performance against the E.O.'s stated requirements.

[4] Energy Independence and Security Act of 2007 (EISA), Energy Policy Act of 2005 (EPAct), U.S.C. and E.O. E.O. 13693 extended and modified the EPAct 2005 renewable energy goal. E.O. 13693 also extended and modified the energy intensity goal to re-baseline to 2015 from 2003.

This report also responds to the following reporting requirements:

- Section 315 of the NDAA for Fiscal Year 2017 (P.L. 114-328) (Appendix E)
  - Efforts to reduce the high energy costs on military installations

- Senate Report 115-125, to accompany S. 1519, the NDAA for FY 2018 (Appendix F)
  - Energy Savings Performance Contracts Assessment
  - Energy Assurance on Military Installations

- House Report 115-200, to accompany H.R. 2810, the NDAA for FY 2018 (Appendix G)
  - Energy Resilience of Overseas Military Installations

- House Report 115-219, to accompany H.R. 3219, Department of Defense Appropriations Bill for FY 2018 (Appendix H)
  - Energy Security of Overseas Military Installations

- Senate Report 114-237 and House Report 115-188, Water Report (Appendix I)

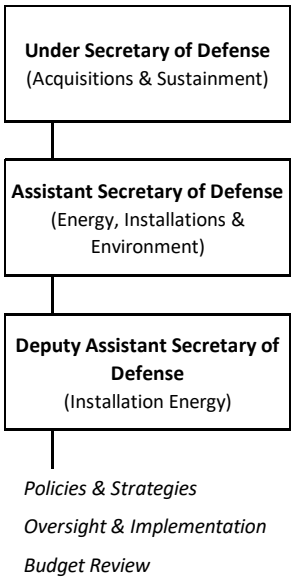
The remainder of this report discusses DoD efforts related to managing its installation energy program, reducing energy demand, increasing distributed (on-site) and renewable energy, and enhancing energy resilience.

2. Installation Energy Program Management

The Office of the Deputy Assistant Secretary of Defense for Installation Energy (ODASD(IE)), Installation Energy Program

The Deputy Assistant Secretary of Defense for Installation Energy (ODASD(IE)) is responsible for issuing energy policy and guidance to DoD Components; coordinating DoD energy strategies; overseeing energy programs (e.g., energy resilience, energy efficiency, and distributed and renewable energy); and engaging with the Military Services, Defense Agencies, and other stakeholders. Additionally, ODASD(IE) coordinates all congressional reports related to installation energy. The following sections briefly describe the DoD Components' installation energy programs.

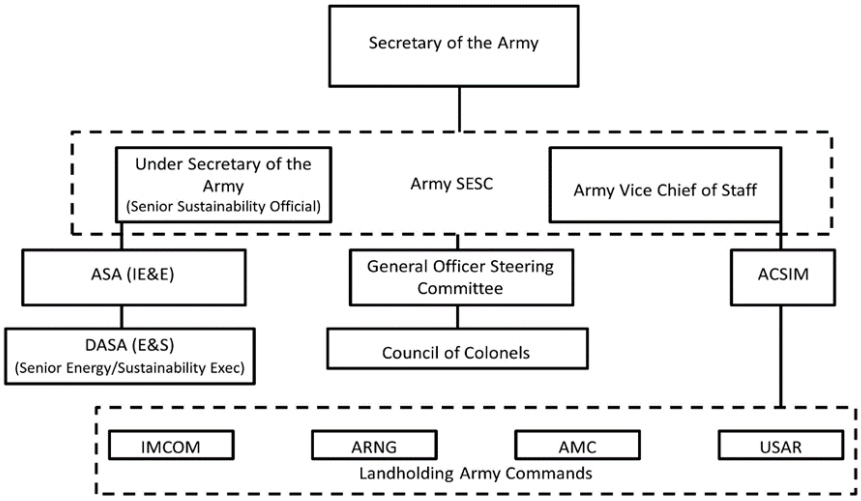
Figure 2-1: Secretary of Defense Installation Energy Program



Army Installation Energy Program

The Army's energy, water, and sustainability programs fall under the purview of the Under Secretary of the Army as the Army's Senior Sustainability Official (SSO). The Assistant Secretary of the Army for Installations, Energy, and Environment (ASA(IE&E)) is the designated official with primary responsibility to support the Under Secretary of the Army in the role of SSO. The Deputy Assistant Secretary of the Army for Energy and Sustainability (DASA(E&S)) is the Army's designated Senior Energy Executive and Senior Sustainability Executive.

Figure 2-1: US Army Energy Program Structure



Energy and water security implementation progress occurs at all levels of command across the Army. Using guidance provided by the Office of the Assistant Chief of Staff for Installation Management (OACSIM), landholding Army Commands monitor their progress against strategic energy security and sustainability goals and take necessary actions to improve performance. OACSIM reports

progress at the Command level to the Senior Energy and Sustainability Council (SESC). The Army periodically reevaluates metrics to foster a culture of continual process improvement.

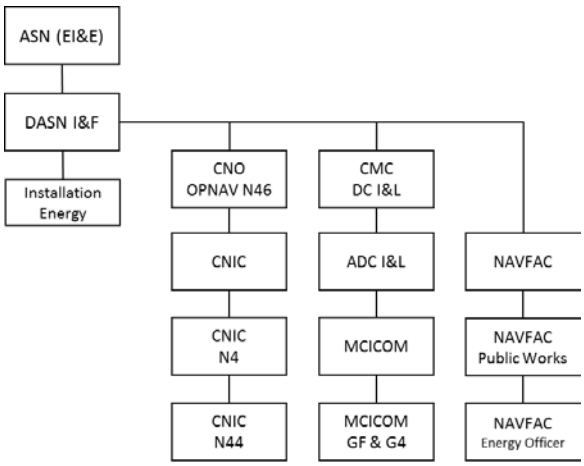
Leveraging the Army's Energy Security and Sustainability (ES^2) Strategy, the SESC fosters more adaptable and resilient installations that are prepared for a future defined by complexity, uncertainty, adversity, and rapid change. The ES^2 has served as a foundational driver for more detailed policy articulating the Army's evolving natural resource security stance. In FY 2017, the Army Directive 2017-07 (Installation Energy and Water Security Policy) coupled with the Energy and Water Goal Attainment Responsibility Policy for Installations formalized a host of legacy energy and water management requirements, specifying their application to the Army. These two Army policy documents provide energy and water management strategies that result in energy and water resilience and ensure the Army's mission readiness in a rapidly changing world.

To further the alignment of energy and water performance to mission performance, the Army is integrating energy and water security into total Army readiness. Improving access to reliable and secure energy and water resources supports strategic resource management goals. Over the last year, the Army has built more comprehensive requirements and detailed metrics to assess installation energy and water security. Requirements for reporting installation status have increased emphasis on the direct impact of energy and sustainability programs and performance to mission readiness. In FY 2018, the Army Strategic Readiness Assessment (ASRA) will report progress and status in installation readiness posture to senior leadership.

Department of the Navy (DON) Installation Energy Program

The Assistant Secretary of the Navy for Energy, Installations, and Environment (ASN(EI&E)) is the designated senior DON official for energy who is responsible for formulating Department-wide policies, procedures, advocacy and strategic plans, as well as overseeing all DON functions and programs related to energy. The Deputy Assistant Secretary of the Navy for Installations and Facilities (DASN (I&F)) is the principal advisor to ASN(EI&E). Within the Secretariat, the Director for Installation Energy facilitates the DON Installation Energy Policy Board, which brings together the senior Navy and Marine Corps officials for energy strategy and policy decisions.

Figure 2-2: Department of the Navy Installation Energy Program



The Office of the Chief of Naval Operations (CNO) Shore Installation Management Division (OPNAV N46) is responsible for developing policy and programming resources for the Navy's Facility Energy Program. OPNAV N46 also ensures compliance with

DON shore energy goals. The Commander, Navy Installations Command (CNIC) is responsible for current and future shore energy requirements across warfare enterprises. Within the Facilities and Environmental Department (CNIC N4) CNIC N44 is responsible for developing and integrating shore energy requirements across the Shore Enterprise.

For the Marine Corps, the Deputy Commandant for Installations and Logistics (DC I&L) is responsible for establishing energy and water management policy for Marine Corps installations in accordance with the Commandant's direction. The Assistant Deputy Commandant for Installations and Logistics (Facilities) serves as the single point of contact responsible for program management and resourcing. The Commander, Marine Corps Installations Command (MCICOM) oversees program planning and execution with direct support provided by the Director, Facilities (MCICOM GF). The Energy and Facility Operations Section (MCICOM GF-1) serves as the Marine Corps Installations Energy Program Manager.

The Naval Facilities Engineering Command (NAVFAC) provides technical and business expertise for facilities, utilities, energy, and other infrastructure support services to the Navy and Marine Corps. The Assistant Commander for Public Works at NAVFAC Headquarters serves as the NAVFAC Energy Officer and oversees the development of relevant energy guidance, standards, processes and internal policy forc NAVFAC.

Air Force Installation Energy Program

Each component of the Air Force Energy Team plays an important role in striving to meet the service-wide energy priorities to: (1) improve resilience, (2) optimize demand, and (3) assure supply. These priorities support the Air Force vision to "enhance mission assurance through energy assurance," which moves the Air Force toward the "sweet spot" of facility energy that is resilient, cost-effective, and cleaner.

The Assistant Secretary of the Air Force for Installations, Environment, and Energy (SAF/IE) is the Air Force's Senior Energy Official and provides guidance, direction, and oversight for all matters pertaining to the formulation, review, and execution of plans, policies, programs, and budgets, as well as Air Force positions regarding federal and state legislation and regulations related to energy and water use. Headquarters Air Force provides:

- Information to support governance and oversight of energy management activities;
- Procedures and objectives to address and manage Air Force facility energy and water consumption, throughput, and requirements, in alignment with policies and strategic direction;
- Policies, guidance, procedures, and practices to enhance Air Force energy assurance with the goal of energy resilience and develop a state of energy security to meet mission essential requirements.

Air Force Installation and Mission Support Center (AFIMSC) and its primary subordinate unit, Air Force Civil Engineer Center (AFCEC) develop and execute facility energy programs, plans, and policies in support of the Air Force strategic energy priorities and goals and are responsible for the integration of major command mission requirements with Air Force strategic energy priorities and goals. Specifically, AFIMSC:

- Assesses energy use and risks to identify investment opportunities and efficiency measures to enhance capability and mission success.

- Provides guidance on energy project development, utility recommendations and requirements validation, capabilities oversight and resource advocacy, and oversight and guidance on budgeting and execution funding.

- Promotes policies, procedures, and practices to enhance Air Force energy security and resilience; and develops standardized processes for the facility energy program.

The Air Force Office of Energy Assurance (OEA) develops, implements, and oversees the integrated facility energy portfolio, including privately financed, large-scale clean energy projects that will provide uninterrupted access to the electricity necessary for mission success.

At the tactical level, installations, supported by Installation Energy Managers (IEMs), develop and execute the installation energy and water plans to support or supplement Air Force energy goals/strategies and measure and evaluate their base energy usage and costs, promote total energy awareness, and nominate successful people and units for energy awards.

Defense Agencies Installation Energy Program

The Defense Agencies continue to enhance their Installation Energy Management Programs and each agency has a designated Senior Energy Official to administer their respective programs (Table 2).

Table 1: Defense Agencies Senior Energy Officials

DoD Component	Senior Energy Official
Defense Contact Management Agency (DCMA)	Energy Program Manager
Defense Commissary Agency (DeCA)	Energy Program Manager
Defense Finance and Accounting Service (DFAS)	Director, Support Services
Defense Intelligence Agency (DIA)	Chief, Engineering and Logistics Officer
Defense Logistics Agency (DLA)	Installation Management Director
Missle Defense Agency (MDA)	Environmental Executive
National Reconnaissance Office (NRO)	Director, Management Services and Operations
National Geospatial-Intelligence Agency (NGA)	Director, Installation Operations Office
National Security Agency (NSA)	Chief of Facilities and Infrastructure Services
Washington Headquarters Services (WHS)	Pentagon Sustainability Program Manager

The Intelligence Community (IC), in particular, has adopted a community-wide approach to maximizing energy opportunities. Within the Office of the Director of National Intelligence there is an IC Energy Management Working Group composed of representatives from the intelligence agencies with the subject matter expertise and authority to speak for their agency on energy matters.

3. Enhancing Energy Resilience

The specific definition of energy resilience provided in section 101(e) of title 10, U.S.C., guides energy policy across the Department. It is important to note that energy resilience is not the same as either energy reliability or energy security. Reliability is a measure both of an electric system's ability to supply the aggregate demand (adequacy) and the system's ability to withstand disruptions (operating reliability).[5] Energy security, defined by section 101(e)(7) of title 10 U.S.C., "means having assured access to reliable supplies of energy and the ability to protect and deliver sufficient energy to meet mission essential requirements." Resilience, as defined for DoD, includes both these abilities, as well as two additional, critical parameters: (1) resilience includes the additional capability to adapt to the environment caused by disruptions; and (2) resilience is targeted at one aspect of the enterprise, mission assurance and readiness.

> *Per section 101(e)(6) of title 10, U.S.C.,* the "term 'energy resilience' means 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 task critical assets and other mission essential operations related to readiness, and to execute or rapidly reestablish mission essential requirements."

DoD relies on commercial power to conduct missions from its installations. Commercial power supplies can be threatened by a variety of events ranging from natural hazards to physical attacks on infrastructure and cyber-attacks on networks. DoD recognizes that such events could result in power outages affecting critical DoD missions involving power projection, defense of the homeland, or operations conducted at installations in the United States directly supporting warfighting missions overseas. Therefore, installation commanders must understand and address the vulnerabilities and risk of power disruptions that can impact mission assurance[6].

Energy resilience can be achieved in a variety of ways, including redundant power supplies (generators); integrated or distributed fossil, alternative, or renewable energy technologies; microgrid applications including storage; diversified or alternate fuel supplies; upgrading, replacing, operating, maintaining, or testing current energy generation systems, infrastructure, and equipment; as well as mission alternative such as reconstitution or mission-to-mission redundancy. 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. What follows from this foundation is an iterative planning and implementation cycle in which mission owners conduct the risk analysis and specify the requirements, infrastructure stakeholders solve for the specified requirements, and the process repeats itself as needed to meet changing mission parameters.

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[5] NERC. 2013. "Reliability Terminology." http://www.nerc.com/AboutNERC/Documents/Terms%20AUG13.pdf

[6] DoD publishes the status of its energy resilience program at the following: http://www.acq.osd.mil/eie/IE/FEP_Energy_Resilience.html.

As part of its energy resilience strategy, DoD adapted policies and guidance related to energy infrastructure. In addition to updating DoD Directive (DoDD) 4180.01, "DoD Energy Policy," and DoD Instruction (DoDI) 4170.11, "Installation Energy Management" in FY 2016, in FY 2017 DoD published the "Energy Resilience: Operations, Maintenance, and Training (OM&T) Strategy and Implementation Guidance." The OM&T Guidance outlines a comprehensive strategy, including a development and implementation plan that replaces or improves emergency power generation readiness, reduces system maintenance, and improves fuel flexibility to ensure the supportability of all Department emergency power generation systems in operation. Further, DoD has incorporated resilience in its annual update of the primary federal investment program specific to energy infrastructure, the Energy Resilience and Conservation Investment Program (ERCIP). On May 30, 2018, DoD released a memorandum to update the OASD(EI&E) memorandum, "Installation Energy Plans (IEPs)," dated March 31, 2016. This update clarifies and provides further direction to installations with regard to energy resilience and cybersecurity. Chief among the updates are requirements that: (1) by the end of FY 2019 all installations identified by the Deputy Assistant Secretary of Defense for Defense Continuity and Mission Assurance as priority installations will complete IEPs; (2) by the end of FY 2020, all installations that constitute 75 percent of each Component's consumption will complete updated IEPs; and (3) by the end of FY 2021, IEPs will be completed for all installations not included in the previous categories. These IEPs provide Components with the opportunity to present their installation-specific long-range plans for energy resilience.

Amendments to sectuin 2925 if title 10, U.S.C., included in the FY 2018 NDAA address how DoD will report to Congress on efforts aimed at increasing energy resilience across the Department. In future AEMRRs, the Department will report on installation energy requirements and critical energy requirements, as well as energy resilience and emergency backup systems serving critical energy requirements. Per section 2925(a)(4) of title 10, U.S.C., the reporting will cover, at a minimum:

(A) Energy resilience and emergency backup systems power requirements;

(B) Critical missions, facility, or facilities serviced;

(C) System service life;

(D) Capital, operations, maintenance, and testing costs; and

(E) Other information the Secretary determines necessary.

ODASD(IE) is actively working with the Services and Defense Agencies to identify and implement best practices to gather and report against these new requirements.

4. DoD's Progress To Achieve Federal & DoD Goals

Installation Energy Demand Overview

This section describes the scope of the Department's installation energy demand in terms of cost and consumption. DoD is the largest single energy-consuming entity in the United States, both within the Federal Government and as compared to any single private-sector entity. DoD operational and installation energy consumption represents approximately 80 percent of total Federal energy consumption, more than sixteen times the total energy consumption of the next closest Federal agency (the United States Postal Service).[7]

In FY 2017, DoD spent approximately $3.48 billion on installation energy, which included $3.3 billion to power, heat, and cool buildings; and $0.18 billion to supply fuel to the fleet of NTVs[8]. The Department also spent $274 million for water in FY 2017, raising the overall cost of energy and water to $3.72 billion. DoD consumed 207,907 billion British thermal units (BBtus) of installation energy; 199,143 BBtus in buildings (stationary combustion) and 8,764 BBtus in NTV fleet (mobile combustion). DoD consumed 89,705 million gallons (MGal) of water; 82,499 MGal in potable water; and 7,205 MGal in industrial, landscaping, and agricultural (ILA) and non-potable freshwater. The Army was the largest consumer of installation energy (36 percent), followed by the Air Force (30 percent), and DoN (29 percent). Electricity and natural gas accounted for 80.5 percent of DoD installation energy consumption. The remaining portion of installation energy consumption included fuel oil, coal, and liquefied petroleum gas (LPG) (Figure 4-1)[9]. DoD's installation energy consumption mix mirrors that of the U.S. commercial sector, where natural gas and electricity dominate the supply mix.

Energy Intensity

DoD measures energy intensity in Btus per gross square foot (GSF) of facility space.[10] Section 543 of the National Energy Conservation Policy Act (NECPA) mandates a 3.0 percent annual reduction in energy intensity relative to a baseline year (FY 2003) or a 30 percent overall reduction from the baseline by FY 2015. E.O. 13693[11] extended the goal to 2.5 percent annual reductions through 2025, with the baseline reestablished to 2015. The EISA of 2007 further distinguishes two categories of buildings: those subject to the energy intensity reduction goal and those that can

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[7] FEMP, Comprehensive Annual Energy Data and Sustainability Performance [online source] (Washington, D.C. April 26, 2018, accessed May 18, 2018), available from http://ctsedwweb.ee.doe.gov/Annual/Report/TotalSiteDeliveredEnergyUseInAllEndUseSectorsByFederalAgencyBillionBtu.aspx

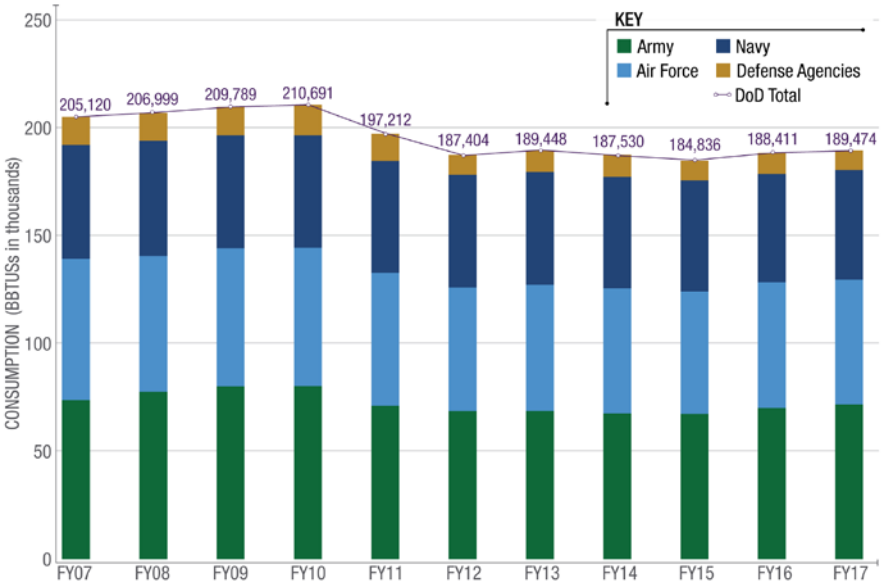
[8] Total DoD consumption and costs for energy in FY 2017 were not available for inclusion in this report.

[9] EIA, 2018 Energy Consumption by Sector, Table 2.1 [online source] (Washington, D.C. April 26, 2018 accessed April 27, 2018), available from http://www.eia.gov/totalenergy/data/monthly/

[10] Energy intensity does not include energy consumption from NTVs.

[11] Since revoked by EO 13834.

Figure 4-1: FY 2017 Installation Energy (Goal Subject) Consumption by Military Service



be excluded.[12] This section discusses energy intensity for DoD goal-subject buildings. In FY 2017, DoD consumed approximately 190,076 BBtus of energy in its goal-subject buildings and 9,067 BBtus in its goal-excluded buildings. Total consumption decreases to 189,474 BBtus when the value is adjusted to reflect for renewable energy credits (RECs). Figure 4-1 illustrates recent historical trends in installation energy consumption by DoD Components across goal-subject buildings.

DoD energy intensity has decreased since FY 2003, but in FY 2016 DoD and the Military Services' progress was recalibrated to an FY 2015 baseline to comply with the new E.O. 13693 guidance. In FY 2017 DoD reduced its energy intensity by 6.4 percent from the FY 2015 baseline, exceeding the goal of 2.5 percent.

[12] The criteria evaluated for excluding facilities include impracticability due to energy intensiveness or national security function, completed energy management reports, compliance with all energy efficiency requirements, or implementation of all cost-effective energy projects in the buildings. This energy intensity section discusses only goal-subject buildings. Source: U.S. Department of Energy (DOE), Energy Efficiency and Renewable Energy, Federal Energy Management Program, Guidelines Establishing Criteria for Excluding Buildings [online source] Washington, D.C. 2006, accessed January 2, 2015, available from http://www1.eere.energy.gov/femp/pdfs/exclusion_criteria.pdf.

Figure 4-2: DoD Energy Intensity Progress Since FY 1975

DoD has reported its energy intensity progress to the Department of Energy (DOE) since FY 1975.[13] Since this time, DoD has reduced its energy intensity from 182,153 BBtus/ft^2 in FY 1975 to 91,714 BBtus/ft^2 in FY 2017 (adjusted for on-site renewables and source energy credits), representing an energy intensity reduction of nearly 50 percent. Figure 4-2 illustrates historical trends in DoD reductions of energy intensity since FY 1975. These reductions are not the result of any single change in technology or practice, but rather reflect a continuous effort to implement solutions across the spectrum of opportunities, from low- and no-cost energy efficiency and conservation measures to larger scale projects to replace and/or upgrade inefficient energy generation, transmission, and distribution infrastructures both on DoD installations and the in the broader commercial energy sector.[14]

[13] EIA, 2018 Energy Consumption by Sector, Table 2.7 [online source] (Washington, D.C. April 26, 2018 accessed April 27, 2018), available from http://www.eia.gov/totalenergy/data/monthly/

[14] Appendix E provides an installation-by-installation breakdown on energy intensity.

Army

In FY 2017, the Army reduced its EUI by 9.6 percent from its FY 2015 baseline. The Army's perspective on facility and installation energy efficiency has evolved from viewing energy efficiency as a means for lowering costs to one that understands that effective and holistic energy management contributes to resilience. Increased energy efficiency is the first step for Army installations to reduce reliance on commercial energy supplies and improve overall energy security. To this end, the Army took specific steps during FY 2017 to build out legacy energy efficiency programs to prioritize energy security/resilience.

In FY 2017, the Army awarded 12 ESPC task orders and modifications with an investment value of $257.4 million, and nine UESC projects worth $31.9 million, for a total of $289.3 million. This represents the second highest year of ESPC/UESC investment ever for the Army. These projects will save 1,132 billion BTUs annually and avoid costs of more than $17.2 million per year which will be used to repay the investments over the life of the contracts. The combined total of all Army ESPC and UESC investments over the life of the program exceeds $2.85 billion. More than 12 additional projects are currently under development. The Army anticipates awarding on average $150 million worth of ESPC/UESC projects each year for the foreseeable future.

Another important action was the update of the Army's ERCIP guidance. The Army collaborated closely with the Office of the Secretary of Defense (OSD) ERCIP Working Group to increase focus of the ERCIP on projects that contribute to energy resilience. The Army's annual ERCIP guidance requires each candidate project to describe how it would contribute to energy resilience and mission assurance (e.g., electricity outage mitigation, energy resource profile diversification, and water resource availability).

The Army continues to leverage its utilities privatization (UP) to achieve significant energy efficiency and modernization upgrades to utility infrastructure. UP represents a cost-effective strategy for addressing deferred maintenance backlogs. The reduced risk and liability associated with transferring infrastructure assets to local utilities, which are often better positioned to initiate corrective actions, represents an energy and water resilience benefit to the Army. As of October 2017, 145 Army utility systems had been privatized across the enterprise.

The Army encourages installations to participate in demand response (DR) programs with their electric and/or water utility providers or through the DLA agreement with curtailment service providers. By shifting energy and/or water use to off-peak hours, DR enables utility customers to reduce utility costs or receive incentives. The Army is assessing market opportunities, developing strategies, and conducting site-specific assessments to determine where DR can reduce and manage utility costs. The Army established a DR database in FY 2017 to track participation and utility savings. In FY 2017, there were 16 Army installations participating in the DR program with financial benefits of $4.2 million credited toward the utility bills of the participating sites.

Combined heat and power (CHP) systems also play a role in the Army's efforts to increase resilience. CHP systems, commonly referred to as cogeneration, recycle thermal energy from electricity generation for heating, cooling, and/or industrial processes. CHP systems typically operate on a near-continuous basis and are more reliable than backup generators, which may not always perform or have the required fuel to operate during prolonged power outages. CHP units

range from large industrial systems to distributed components having capacities less than 100 kW. The Maine Army National Guard (ARNG) recently deployed such a novel "micro" CHP design by installing a 75 kW unit in an aviation support facility in Bangor, Maine. This project enhances energy security by significantly reducing energy demand and generating onsite electricity and heat for the Maine ARNG's largest facility. This year Army has renewed its efforts to deploy new CHP systems by establishing a CHP integrated process team that engages Army stakeholders in a collaborative process to ensure CHP is considered as a key piece of the Army's ES^2 Strategy. Army FY 2017 initiated a new strategy to guide future deployment of CHP. This document was signed by the Secretary of the Army in December 2017. The Army awarded approximately 2 MW of new CHP in FY 2017.

The aforementioned energy program priorities have enabled the Army to better measure and manage its energy consumption. With an overall EUI of 77.8 thousand BTU per square foot per year, the Army has a lower EUI than most other Federal Agencies and is the lowest among the four Services. The Army will continue to identify and implement the most cost-effective EUI reduction measures while still maintaining mission readiness.

DON

In FY 2017, the DON reduced its EUI by 6.2 percent compared to its FY 2015 baseline. The Navy reduced its EUI by 5.0 percent, while the Marine Corps reduced its EUI relative to the FY 2015 baseline by 9.8 percent. Both the Navy and the Marine Corps expect progress to continue toward building greater energy resilience at installations utilizing federal and non-federal financing during FY 2018.

By early FY 2017, the Navy and Marine Corps had awarded $654 million in projects designed to leverage energy savings potential to increase installation energy resilience. These investments are expected to help DON continue to reduce its energy use by 165 BBtus each year for the next 20 years. The following are examples of energy resilience projects in FY 2017:

- The $92 million Energy Savings Performance Contract (ESPC) at MCRD Parris Island includes eight energy conservation measures that result in a total energy use reduction of 35 percent and total water use reduction of 25 percent. It also includes a new central plant with microgrid and island mode capability and a total of nine MWs of on-site electrical generation, which will improve the energy reliability and resilience of the installation as well.

- The $150 million steam decentralization project at Camp Lejeune that replaced five outdated steam utility systems with 641 small high-efficiency natural gas hot water condensing boilers. This project used multiple funding streams (Energy Investment Program [EIP] - $73.8 million, ERCIP - $11.7 million, MILCON - $26 million, UESC - $38 million) and accounted for the operation of 548 buildings at the base through the life of the project. The project eliminated 50 miles of steam and condensate piping, improving the efficiency of the system by more than 50 percent, reducing vulnerabilities, and limiting

maintenance. Additionally, the switch to hot water condensing boilers eliminated the need for steam make-up water systems, saving the base approximately 87 million gallons of water per year. In total, the base is expected to save approximately $15.3 million in annual savings with a payback period of less than 10 years.

Air Force

In FY 2017, the Air Force reduced its EUI by 4.6 percent compared to its FY 2015 baseline. The Air Force did not meet the EUI reduction goal of 5.0 percent, due primarily to environmental impacts at certain installations. Total reportable energy consumption for the Air Force did decrease by 0.2 percent in FY 2017 resulting in savings of $17 million, down from $939 million in FY 2016.

The Air Force continues to use Facility Sustainment, Restoration and Modernization (FRSM) and ERCIP funds, along with various third-party financing opportunities such as ESPCS, and UESCs. Funds were primarily used to convert to high efficiency lighting and replace inefficient heating, ventilation, and air conditioning (HVAC) systems with more efficient systems. Several installations indicated that improving the facility related control systems (FRCS) significantly improved energy conservation. Various awareness programs continue to educate and motivate personnel across installations to contribute to energy reductions.

Review of information received from installations where consumption increased indicated more extreme weather conditions and intensive construction activities. For example, the F-35 beddown, or the Beneficial Occupancy for KC-47 buildings contributed to a nine percent energy consumption increase at McConnell Air Force Base (AFB), KS. Several installations also noted that the lack of energy management personnel and reduced resource efficiency manager (REM) support hinders energy program effectiveness. With regard to weather conditions, several Air Force locations were affected by natural disasters: Offutt AFB, NE was without electricity for 2½ days due to tornado damage in June 2017; Hurricanes Matthew (October 2016), Irma (September 2017) and Maria (September 2017) affected Patrick AFB, FL, Cape Canaveral, FL and Seymour Johnson AFB, SC, with total electrical outage time of six days. Additionally, the Air National Guard was also significantly impacted at its locations in Puerto Rico and the Virgin Islands due to hurricanes Irma and Maria.

Defense Agencies

In FY 2017, the Defense Agencies continued to pursue opportunities to reduce EUI. Some highlights of successes are included below:

- FY 2017 was a successful year for DLA with total energy consumption reduced by 1.01 percent and EUI decreased by 3.01 percent, exceeding the 2.5 percent per year goal set by E.O. 13693. All four DLA host sites reduced EUI in FY 2017.

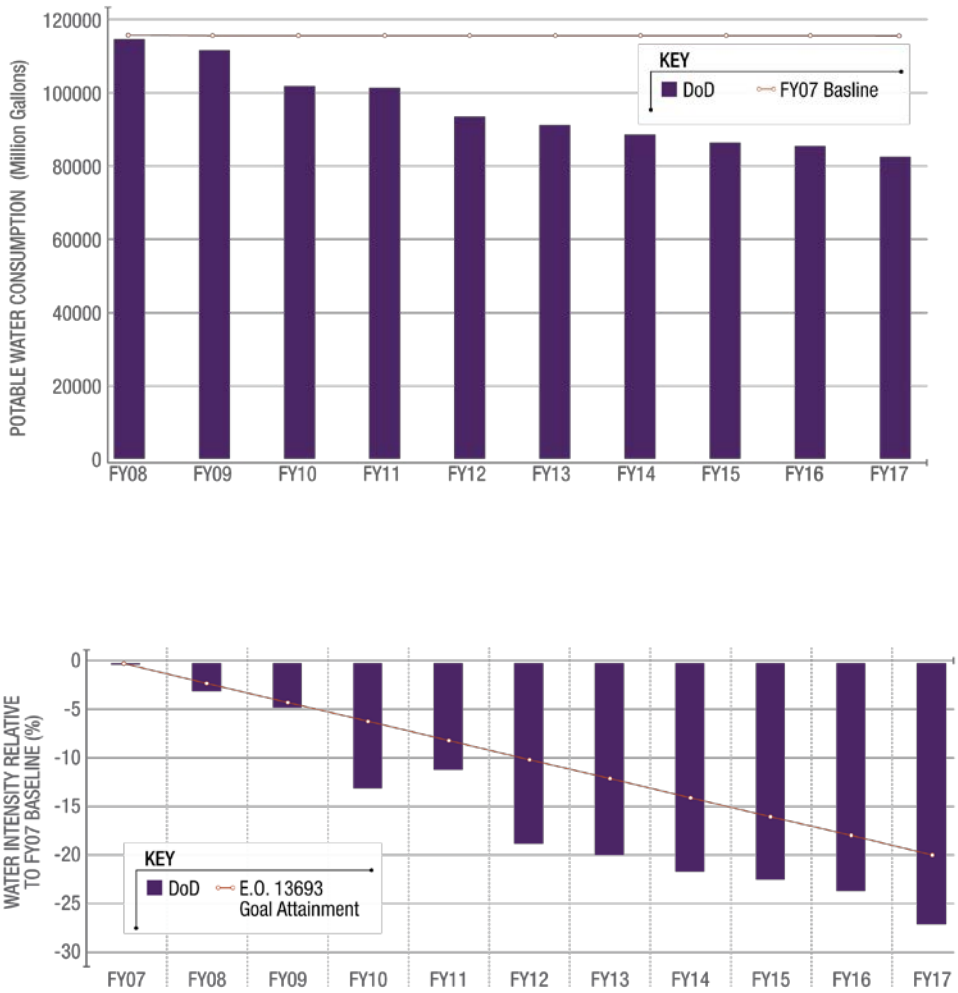
- WHS decreased EUI at the Pentagon and Mark Center by 8.6 percent from the FY 2015 baseline. Electricity is the main driver of EUI for the Pentagon, accounting for roughly two-thirds of total energy use. The Pentagon's energy usage continues to decrease because of investments in energy conservation. One of the primary drivers has been the recommissioning and ongoing commissioning projects, which restore, maintain, and increase mechanical system energy efficiency; reduce maintenance burdens; and improve tenant satisfaction. Recommissioning and commissioning activities include optimizing computer room air-conditioning (CRAC) unit set points, repairing or replacing fans, correcting damper air leaks, fixing leaking cooling and heating valves, and more. Additionally, in accordance with new AHSRAE 62.1 guidelines, WHS has optimized outside air set points for several air handling units, with a plan to complete optimization on the remaining units in FY 2018. WHS building maintenance staff are also using fault detection and diagnostics to prioritize and correct energy issues that would go unnoticed under normal tenant feedback channels.

Potable Water Consumption and Intensity

E.O. 13693 required that Federal agencies achieve a potable water intensity reduction goal of 36 percent by FY 2025 relative to the FY 2007 baseline. DoD potable water consumption has decreased consistently relative to the FY 2007 baseline. In FY 2017, DoD facilities consumed 82,500 MGal of potable water, with the Military Departments accounting for over 98 percent of total DoD potable water consumption. DoD FY 2017 water intensity of 43.6 gallons per square foot (Gal/SF) is a 26.9 percent reduction from the FY 2007 baseline and exceeds the 20 percent FY 2017 target reduction by nearly seven percent.

> ***Potable Water*** *includes water purchased from a utility (water) provider and all fresh water (e.g., well and streams) treated and added to the domestic (for human consumption) system.*

Figure 4-3: DoD Potable Water Consumption FY 2008- FY 2017



Army

Similar to energy management, the Army maintains a focus on water security and resilience. Guided by both the recently published Army Directive 2017-07 (Installation Energy and Water Security Policy) and the Energy and Water Goal Attainment Responsibility Policy for Installations, the Army exceeded potable water intensity and ILA water reduction goals in FY 2017. The FY 2017 potable water intensity of 39.2 Gal/SF is a 32.0 percent reduction from the Army's FY 2007 baseline, which is 12.0 percent ahead of the FY 2017 target of 20 percent.

The first "line of defense" of the Army's focus on water security is to reduce water demand and increase efficiency. By reducing water use, Army installations have lower critical water loads that in turn create a more resilient installation. Examples of exemplary programs include water conservation achieved at the Presidio of Monterey. The installation implemented native landscaping and installed a stormwater reuse system to irrigate the installation's athletic field. These projects reduced irrigation water use by 70 percent. Sierra Army Depot implemented low-cost water conservation measures that included lawn irrigation restriction, reduction of operation hours at wash rack facilities, and installation of high-efficiency showerheads in on-post apartments and barracks, resulting in a 25 percent water reduction. Fort McCoy implemented water conservation measures such as irrigation efficiency projects and synchronization of fire flow testing with annual distribution system flushing that reduced the amount of water lost through these required system testing activities.

The Army's UP program improves the reliability of Army water systems, which minimizes potential disruption to operations. The Army has privatized 41 water systems to date.

Army installations are implementing infrastructure projects to help increase water security. For example, Fort Irwin completed construction of a new highly efficient water treatment plant that has a 99 percent water recovery rate, substantially reducing waste in the treatment process. Both Fort Irwin and Fort McCoy upgraded aging potable water lines to increase the reliability of their distribution systems, which are critical to installations' water resilience. The Fort Irwin Department of Public Works (DPW) staff also collaborated with their privatized housing contractor to initiate mock billing of housing, which reduced water consumption by 26 percent in the housing area.

In terms of ILA water performance the Army established an FY 2013 baseline because data quality was higher than had been available during earlier fiscal years. The Army expects to continue exceeding ILA water reduction goals in future FYs due to recent reporting modifications and robust training efforts.

The Army is developing alternative sources for water, such as rainwater harvesting and reclaimed wastewater, to improve resilience by reducing dependency on groundwater and potable water supplied through municipalities. The new water treatment plant at Fort Irwin, described above, enabled construction of a new recycled water line for irrigation through the UP contract. This capital investment was credited with reducing potable water consumption by 11.9 MGal annually.

The Army Reserve developed an alternative water strategy to prioritize implementation of alternative water to increase water resilience at Army Reserve facilities. As part of this strategy, the Army Reserve evaluated regions of the US that are best suited for rainwater harvesting and implemented two pilot projects at Army Reserve Centers in Savannah, GA and Grand Prairie, TX. The projects supply rainwater for the facilities' vehicle wash systems. In addition, Fort Buchanan received funding from the Installation Technology Transition Program to implement a solar-powered potable rainwater harvesting system in FY 2017. The system will demonstrate how a self-contained potable water system can provide a reliable source of water to an Army facility.

DON

In FY 2017, DON's potable water intensity was 23.5 percent below the FY 2007 baseline. This high level of performance is driven by the Marine Corps, with a reduction of more than 39.6 percent from its FY 2007 baseline.

The Navy's potable water intensity was 18.1 percent above its FY 2007 baseline[15]. Water intensity performance for the Navy is expected to improve as ESPC and UESCs with water conservation measures that were awarded under the PPCC complete construction. For example, a UESC under construction in FY 2017 is expected to save more than 42 million gallons annually once it is complete in FY 2018.

Water conservation efforts were largely incorporated into larger ESPC and UESC project scopes in FY 2017, such as in the case of the UESC at NCBC Gulfport. Consistent with the holistic and strategic perspective of the Installation Energy Security Framework, the DON worked throughout the fiscal year to examine the relationship between water and energy in the southwestern United States in executing installation mission requirements and the contributions water resiliency has to the overall energy security posture of an installation. This analysis of factors that impact, and thereby can improve, the integrated management of water and associated energy resources at select installations, gives the DON a greater understanding of water resilient operations. In FY 2017, the DON identified a portfolio of potential opportunities and associated project funding mechanisms that could be pursued in accordance with the Department's overall energy security strategy in the coming years.

[15] DON Defense Utility Energy Reporting System (DUERS) reports DON's FY17 potable water intensity decrease at 18.35% below the FY 2007 baseline. For the sake of consistency in reporting across the Department, the report has retained the FEMP-reported value in the main text of the report.

Air Force

Overall the Air Force continued to reduce potable water intensity relative to the FY 2007 baseline, reducing intensity by 24.1 percent in FY 2017, although intensity was 0.48 percent higher than FY 2016. Specifically, water intensity increased from 42.1 Gal/SF in FY 2016 to 42.3 Gal/SF in FY 2017 and water consumption increased from 22,000 MGal in FY 2016 to 22,200 MGal in FY 2017. Overall, however, consumption was reduced from 34,000 MGal in 2007 to 22,000 MGal in 2017. Installation inputs indicate standard practices continue to support water conservation efforts. The primary factors include: (1) leak detection and infrastructure repair, (2) fixture replacement and upgrade, (3) moving toward xeriscaping, and (4) using non-potable sources whenever possible. By focusing on the above areas, along with other water conservation initiatives, the Air Force will continue to meet water conservation goals.

The Air Force will continue to emphasize water conservation awareness through Energy Action Month and various other educational and public awareness avenues.

The following examples are indicative of water conservation efforts around the Air Force:

- Kadena AB, Japan, reduced consumption 35 percent (690 MGal) by repairing significant water leaks early in the FY.

- Hill AFB, UT, upgraded the water system and steam condensate return systems.

- Eglin AFB, FL, reduced water consumption 32 percent (106 MGal). The energy management team and the 796 CEO flight work closely with ASUS (Utilities Privatization contractor) to support, identify, validate and implement common sense strategies to mitigate leaks and formalize processes to maximize avoided water/wastewater related energy costs through innovative load avoidance and reduction techniques.

- Nellis AFB, NV, reduced water consumption 10 percent (54 MGal). Nellis AFB is located in the Mojave Desert and receives only 3.5 inches of rain per year on average; water conservation is critical. Past projects to replace water thirsty grass with efficient desert landscaping have led to significant water usage intensity reductions.

- Although Peterson AFB, CO, experienced a 25 percent increase in water consumption in FY 2017 due to low precipitation, a 10-acre turf grass reduction project was begun in FY 2017 and is expected to save 14 MGal per year.

- Travis AFB, CA, is implementing a Smartscape policy after California eased drought restrictions and the installation had a measurable increase in consumption. This policy will re-evaluate irrigation priorities and replace current landscaping with more drought tolerant species.

- Wright Patterson AFB, OH, indicates an upcoming Energy Savings Performance Contract is expected to reduce water consumption by approximately 4.8 MGal per year.

Defense Agencies

In FY 2017, Defense Agencies consumed 53 percent less potable water than the FY 2007 baseline and the Agencies continue to pursue additional opportunities to reduce potable water intensity.

- In FY 2017, NSA initiated the purchase of reclaimed water, primarily as make-up water for cooling towers, resulting in an approximately 58 percent decrease in potable water use from FY 2016.

- Defense Intelligence Agency (DIA) continued to leverage a comprehensive water conservation program that includes optimized use of industrialized chilled water at all of its facilities, resulting in a 37 percent decrease in water use intensity. In FY 2018, DIA will continue to pursue permits to allow on-site groundwater for non-potable use in its cooling towers, further decreasing DIA's potable water consumption.

Industrial, Landscaping, and Agricultural (ILA) Water Consumption

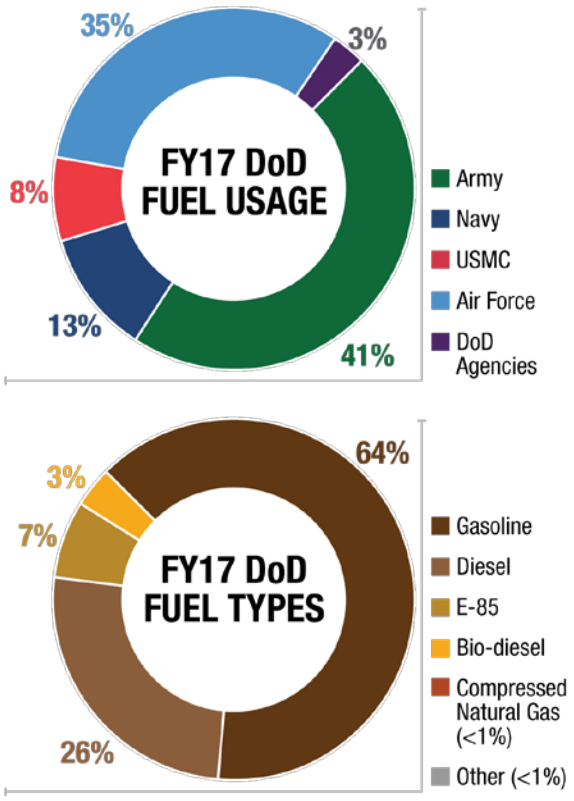
In FY 2009, E.O. 13514 established a new water reduction goal. The goal requires Federal agencies to reduce ILA water consumption by two percent annually, or 20 percent by FY 2020, relative to an FY 2010 baseline. This was extended through 2025 in E.O. 13693. In FY 2015, DoD established supplemental guidance for Components to establish a baseline, and measure and estimate ILA water use that sets Components' baseline year to FY 2016 as opposed to EO 13693's baseline year of 2010. In FY 2017, DoD reduced ILA water consumption by 39 percent relative to the FY 2010 federal baseline.

ILA Water includes naturally occurring water (e.g., lake, well, river water that is not treated [fresh]) used in an ILA application. ILA also includes any non-potable water purchased from a third party.

Non-Tactical Fleet Vehicle Petroleum Consumption

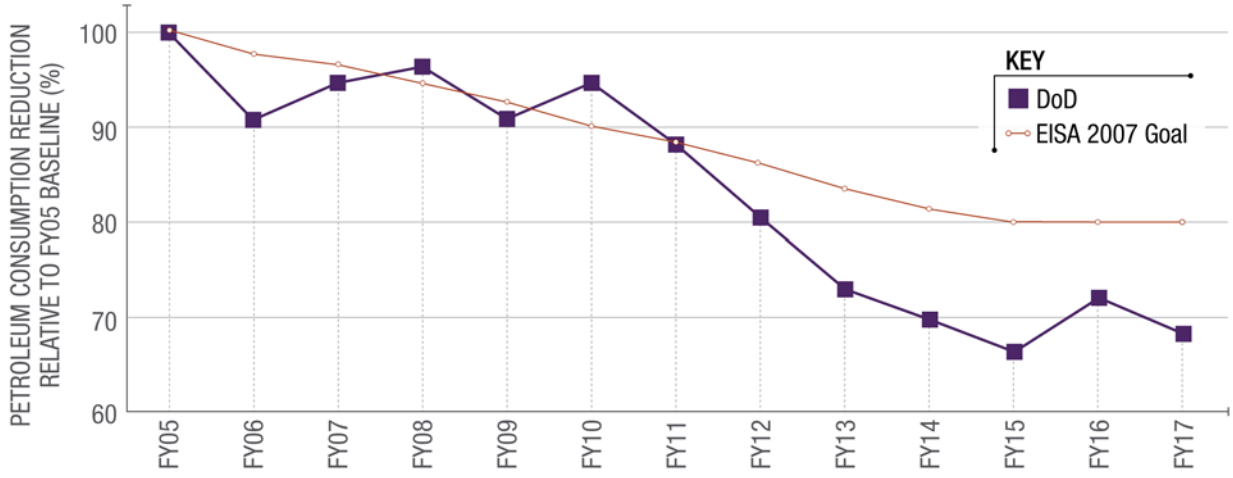
E.O. 13693 requires Federal agencies to reduce per-mile greenhouse gas (GHG) emissions 30 percent by FY 2025 from a FY 2014 baseline. This requirement, along with alternative fuel progress, is reported in the DoD Strategic Sustainability Performance Plan (SSPP). Fleet vehicle fuel consumption in FY 2017 accounted for about 4.3 percent of DoD installation energy consumption and 5.2 percent of DoD installation energy cost. The energy mix consisted of 67 percent gasoline, 30 percent diesel, and the remaining three percent was alternative fuels. The Military Departments accounted for slightly more than 98 percent of the Department's fleet vehicle petroleum consumption (Figure 4-5).

Figure 4-5: FY 2017 Fleet Vehicle Petroleum Consumption



In FY 2017, DoD fleet vehicles consumed 70.1 million gallons of gasoline equivalent (GGE), which includes gasoline and diesel. The mix of petroleum fuel types has remained relatively stable over the past seven years, and the use of alternative fuel vehicles (AFVs) has steadily increased. In FY 2016, 10.4 percent of the total fleet vehicle consumption was from alternative fuels, an increase over the 2005 baseline of 2.2 percent. Alternative fuels include biodiesel, compressed natural gas (CNG), 85 percent ethanol fuel (E85), and hydrogen. DoD continues to pursue replacement of fleet vehicles with more efficient models, AFVs, and hybrid-electric vehicles to decrease petroleum consumption. Overall, DoD fleet vehicles consumed 68.3 percent of the fuel, which is nearly 17 percent less than the EISA-established 80 percent reduction target for FY 2017 (Figure 4-6).

Figure 4-6: FY 2017 Fleet Vehicle Consumption Relative to FY 2005 Baseline



Army

In FY 2017, the Army furthered its energy security by exceeding the cumulative fossil fuel reduction goal of 24 percent with an approximate 40 percent reduction. This also exceeds the mandated FY 2020 cumulative goal of 30 percent. The Army continues to follow the E.O. 13693 to guide its fossil fuel consumption reduction efforts. The Army's non-tactical vehicle (NTV) fleet decreased by 923 NTVs in FY 2017, which increased the Army's overall reduction of NTVs to 14,355 vehicles since FY 2011. The Army is optimizing its NTV fleet annually through the Vehicle Allocation Methodology (VAM)/Vehicle Utilization Review Board (VURB) process. Every NTV not meeting utilization goals must be validated and approved by the Senior Commander for retention. The strategy to meet and exceed the GHG goals is to replace passenger vehicles meeting age or mileage criteria with hybrid, plug-in hybrid, or zero emission vehicles. Buses and larger trucks are being replaced with compressed natural gas or liquid petroleum gas vehicles. This strategy facilitates fossil fuel reduction and lowers greenhouse gas emissions in the most economical and mission-effective manner. The Army continues to leverage assistance from the U.S. Department of Energy (DOE) to conduct installation site surveys for properly locating electric vehicle charging infrastructure. Site surveys are considering current requirements and an estimate of future requirements through FY 2030.

DON

The DON continued to improve NTV fleet operations in replacing internal combustion engine (ICE) vehicles with electric vehicles (EVs) and implementing alternate transportation methods. In FY 2017, the USMC launched a Mobility Transformation Strategy (MTS) to develop mobility solutions that: advance the incorporation of analytics into NTV fleet operations to improve safety and maintenance; partner with industry leaders to identify and implement cost savings strategies; improve accessibility and convenience; and right-size the NTV fleet in to increase efficiency and

resilience in fleet operations. The MTS identified a variety of elements that will be further researched, including: on-demand mobility services (Car-sharing and Ride-hailing), consolidated vehicle pools, electric and autonomous vehicles, telematics, public transportation, bike sharing and walkability, and troop and cargo movement.

For the first reporting year since establishment of the NTV fleet-wide per-mile GHG emission reduction goal, the DON exceeded the two percent target by achieving an overall 12.8 percent reduction. Navy NTV fleet carbon dioxide equivalent/mile (CO2e/mile) decreased from 565.35 to 507.15 (10.3 percent) and Marine Corps NTV fleet CO2e/mile decreased from 483.4 to 388.7 (19.6 percent). The DON continues to pursue effective use of alternative fuel vehicles (AFVs), fuel-efficient technologies, and fleet optimization in order to meet the 30 percent NTV fleet-wide per-mile GHG emission reduction goal by FY 2025.

Air Force

Although the Air Force has experienced a 9.3 percent increase in fuel consumption relative to the FY 2005 baseline, the Air Force remains committed to reducing the use of petroleum products in its NTV fleet as well as increasing the use of alternative fuels in order to meet E.O. 13693. The Air Force's enterprise-wide fleet managers, the 441 Vehicle Support Chain Operations Squadron (VSCOS), has implemented many programs that directly contribute to the success of this federal mandate by way of procurement, plug-in electric vehicle (PEV) fleets, Vehicle Validations (VV) and the testing of new products intended to assist the USAF in meeting Federal and DoD sustainable procurement directives, Federal Acquisition Regulations and Reduce dependence on foreign petroleum.

The bio-based four cycle engine oil project is demonstrating bio-based engine oil in NTVs at eight sites (four USAF sites) with 68 vehicles in varying climate locations over four seasons. The test is designed to evaluate the impact on overall maintenance performance, longevity, and environmental or "green" impact. This demonstration is underway with final report (and anticipating established National Stock Number) expected in early 2018.

The Air Force is also evaluating other technologies that can reduce energy consumption, like commercial off the shelf kits that can reduce engine idling. Additionally, the Air Force is developing a framework to improve agility, energy efficiency, safety, reliability, maintainability, operator environmental conditions, and reduce hazardous greenhouse gas emissions by demonstrating the feasibility of hybridizing low density, mission specific vehicles. The 25K Halvorsen Loader, an operational, air-transportable and worldwide deployable vehicle, will be the first subject of this hybrid demonstration. The project just initiated and demonstration results are expected in 2020.

Defense Agencies

In FY 2017, the Defense Agencies accounted for 3.2 percent of DoD fleet petroleum consumption and continued to pursue opportunities to reduce petroleum consumption.

- In FY 2017, DIA reported a 12.3 percent decrease in fuel use in the vehicles it leases from the Gernal Services Administration (GSA), exceeding the DoD requirement of nine percent, and even improving on the previous FY's 11.7 percent reduction. DIA's fuel use reduction was achieved by reducing the amount of driving done by the vehicles it operates, along with replacing many of its larger sedans with more fuel efficient vehicles. In FY 2018, DIA plans to add additional GSA EVs when it opens a new parking garage at DIA HQ equipped with EV charging stations. In addition, the DIA Vehicle Program Manager will continue to request that GSA provide DIA with the most fuel efficient vehicles that meet mission requirements.

- DLA continues to make positive efforts in consumption of vehicle petroleum use with Defense Supply Center Columbus further reducing its use by 9.41 percent for an overall 59 percent decrease against the FY 2007 baseline.

5. Increasing DoD Distributed (On-site) and Renewable Energy Resources

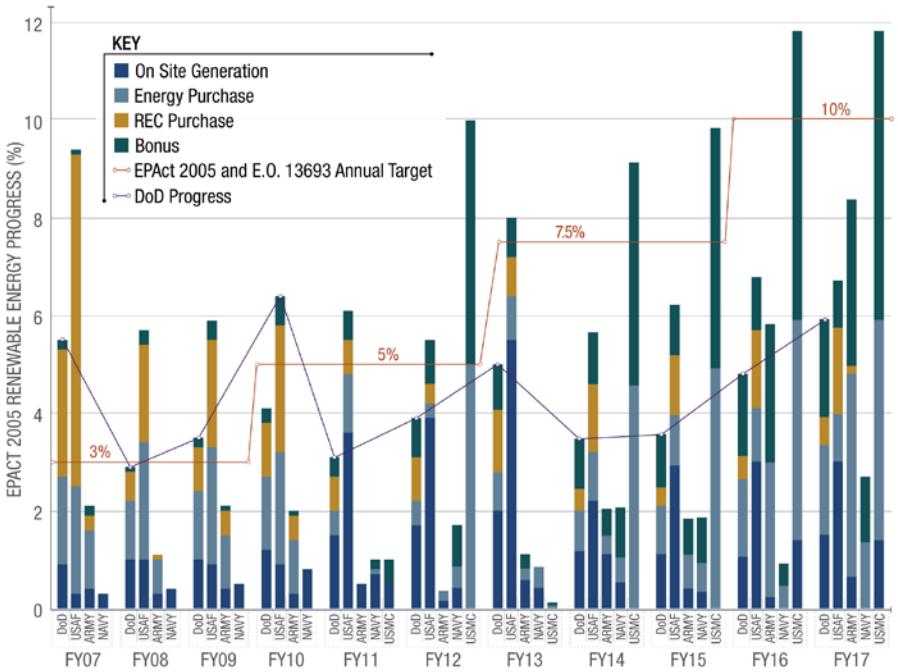
In addition to reducing facility energy demand, DoD is increasing the supply of distributed (on-site) and renewable energy on installations. DoD continues to invest in cost-effective renewable and distributed energy solutions that meet the Department's strategy to prioritize energy resilience and bolster mission assurance.

DoD Renewable Energy Performance

As DoD pursues renewable energy to advance its energy resilience, it also seeks to comply with legal requirements to increase its renewable energy supply. The Department is subject to two renewable energy goals: (1) Section 2911(g) of title 10, U.S.C., and (2) Section 203 of the Energy Policy Act (EPAct) 2005 (Section 15852 of title 42, U.S.C.). The EPAct 2005 goal considers total renewable electricity consumption as a percentage of total facility electricity consumption, with the goal of 7.5 percent by 2013 and every fiscal year thereafter. E.O. 13693 continued and extended the EPAct goal to 25 percent by 2025 with the intermediate goal for FY 2017 set at 10 percent. In FY 2017, DoD did not achieve the EPAct or E.O. 13693 goals. Renewable electricity consumption subject to these requirements was 5.9 percent of DoD total electricity consumption, falling short of the 10 percent goal.

Section 2911(g) of title 10, U.S.C., established a goal for DoD to produce or procure not less than 15 percent by FY 2018[16] and 25 percent of the total quantity of facility energy it consumes within

Figure 5-1: EPAct of 2005 and E.O. 13693 Renewable Energy Goal Attainment

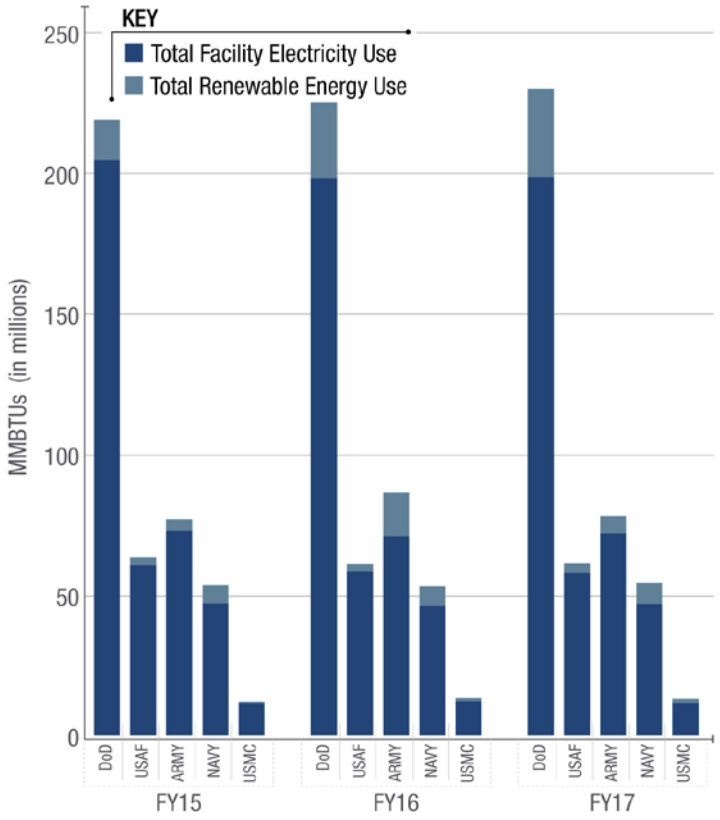


[16] This interim renewable energy goal was established as part of the Energy Performance Master Plan in the FY 2011 AEMR. See Appendix C for details on DoD energy goals.

its facilities by FY 2025 and each fiscal year thereafter from renewable energy sources. DoD progress toward the section 2911(g) of title 10, U.S.C., renewable energy goal in FY 2017 was 8.74 percent (Figure 5-2).

The Department uses various authorities to increase the supply of distributed (on-site) and renewable energy sources on its installations. DoD uses both appropriated funds and non-Governmental (often referred to as 'third-party') financing to pursue renewable energy projects. DoD partners with private entities to enable the development of large-scale renewable (or other distributed) energy projects and relies on congressional appropriations to fund cost-effective, small-scale distributed generation projects. The main authorities utilized to pursue third-party financing of renewable energy projects are Utility Service Contracts (USCs), Power Purchase Agreements (PPAs), and outgrants (Table 5-1). Sections 2922(a) and 2667 of title 10, U.S.C. are not limited to renewable energy sources and can also be used for non-renewable energy sources such as natural gas and other fuel types. Section 2410(q) of title 10, U.S.C. is limited to renewable energy sources.

Figure 5-2: 10 U.S.C. Section 2911(g) Renewable Energy Goal



Funding Mechanism	Authority	Definition
Utility Service Contracts (USCs)	10 U.S.C. § 2410q	A contract enabling the DoD to enter into agreements for the provision and operation of energy production facilities and the purchase of energy from such facilities.
Power Purchase Agreement (PPA)	10 U.S.C. § 2922(a)	An agreement enabling the DoD to enter into a contract for the purchase of electricity from sources of renewable energy.
Energy Enhanced Use Leases (EULs)	10 U.S.C. § 2667	An EUL for the production of energy allows an installation to lease land to a lessee in return for cash or in-kind contributions. For renewable energy projects that use the authority found under 10 U.S.C. § 2667, DoD requires that the Military Department demonstrate more than a mere passive activity. For production or procurement of facility energy to qualify as being consistent with the DoD energy performance goals and master plan (and consequently qualify for an energy certification), DoD must do one of the following– • Consumption by the DoD Component of some or all of the facility energy from the project; • Structure the project to provide energy security for the installation by, e.g., retaining the right to divert to the installation the energy produced by the project in times of emergency; • Reinvestment in renewable facility energy or program conservation measures of a minimum of 50 percent of proceeds (including both in-kind and cash) from any lease.

Table 5-1: Non-Federal Funding Mechanisms

Army

Renewable energy production and utilization is essential to meeting the Army energy resilience goals. Assured access to reliable supplies of energy and the ability to protect and deliver sufficient energy to meet operational needs is a chief goal of Directive 2017-07, and the "Assured Access" category within the revised ISR-MC metrics now includes questions to determine the percent of onsite generation from renewable energy sources. Onsite renewable energy provides a means to diversify supply at installations and reduce reliance on commercial energy grids in cases where the energy can be used on the installation. Securing reliable energy supplies to support the Army's mission is a primary goal of the Army's renewable energy strategy.

In FY 2017, the Army increased its renewable energy capacity for a third year in a row. The Army added 176.1 MW of renewable electricity capacity in FY 2017 through 33 new projects for a total of 428.6 MW, a 69.7 percent increase from FY1 2016. The total percentage of renewable electric energy eligible toward the EPAct 2005 goal increased from 5.8 percent in FY 2016 to 8.4 percent. The renewable energy production credited toward the NDAA 2010 goal increased by 3.6 percent

from FY 2016 to FY 2017. The Clean Energy goal is not comparable year over year, as it was a new metric in FY 2016 and the calculation methodology for FY 2017 changed.

The Army continues to employ a comprehensive approach to renewable energy, focusing on supporting installation mission requirements. The Army's cost-effective investments include small-scale projects on rooftops and parking areas, larger projects funded through ERCIP or financed through ESPCs and UESCs, as well as utility-scale projects leveraging private financing through available Federal and DoD authorities. In FY 2017, the Army added 14.8 MW of renewable electricity capacity through a variety of programs that leverage private or third-party financing, such as Power Purchase Agreements (PPAs), ESPC/UESC, or GSA area-wide utility contracts. The Army's Office of Energy Initiatives (OEI) facilitates utility-scale projects by leveraging private equity. In FY 2017, the OEI added 142.0 MW of renewable electricity capacity with efforts focused on the development of generation projects that include energy storage and controls to allow the power to support the installation requirements in the event of a grid outage. Examples of this are agreements with local utilities, such as the 10 MW and 7 MW projects at Fort Rucker and Anniston Army Depot in Alabama. Other efforts were forged with independent renewable energy providers, such as the new 50 MW of off-site wind generation combined with a 15 MW onsite solar facility at Fort Hood, TX.

The Army also leveraged third party financing to install 15.3 MW of renewable electricity generation through the Residential Communities Initiative. Finally, 2.1 MW of renewable electric generation was brought online through ERCIP and MILCON funded projects.

DON

In FY 2017, Navy did not achieve the E.O. 13693 renewable electricity annual target of 10 percent, consuming only 2.1 percent of electricity from renewable energy sources for the year. The Marine Corps progress toward meeting the E.O. 13693 target was 10.5 percent. The Navy's performance regarding the renewable electricity goal is a function of the strategic decision to allow other parties to monetize the value of RECs associated with its financed energy projects. Because REC ownership is a requirement to claim credit towards the E.O. 13693 renewable electricity goal, the Navy is unlikely to show significant progress towards this particular goal despite intensive efforts to facilitate renewable energy production and consumption on, and for, its installations.

Finally, the DON continued to make exceptional progress against the DoD renewable goal established in section 2911(g) of title 10, U.S.C. In FY 2017, the Navy produced or procured 16.17 percent of renewable energy relative to electricity consumed. This marks the fourth consecutive year the Navy has achieved the interim FY targets toward the 25 percent by FY 2025 2911(g) goal. The Marine Corps produced or procured 12.26 percent of renewable energy relative to electricity consumed.

Air Force

In FY 2017, 6.7 percent of the electrical energy used by the Air Force was produced from renewable sources. This represents a decrease of 17,759 MWh from the 6.8 percent in FY 2016, and is below the FY 2017 EPAct 2005 /E.O. 13693 goal of 10 percent. In addition, the Air Force performance toward the section 2911(g) of 10, U.S.C. goal (producing or procuring at least 25 percent of facility energy from renewable energy sources by the year 2025) was 8.4 percent for both electric and non-electric energy used in FY 2017.

Renewable performance in FY 2017 was negatively impacted primarily due to the termination of a contract at Hill AFB, UT, to purchase steam from an energy recovery facility with municipal solid waste. Additionally, Robins AFB, GA, terminated green energy purchases from the local utility and the Landfill Gas generation plant at Joint Base Elmendorf Richardson, AK, produced less than expected.

Major operational renewable energy projects in FY 2017 included:

- 14.2 MW and 19 MW arrays using a Power Purchased Agreement at Nellis AFB, NV.
- 16.4 MW Power Purchased Agreement array at Davis Monthan AFB, AZ, using an indefinite term Federal Acquisition Regulation Part 41 contract mechanism.
- Six MW Power Purchased Agreement array at US Air Force Academy, CO.
- Three MW Power Purchased Agreement array at Edwards AFB, CA.
- 3.4 MW wind project at Cape Cod AFS, MA.
- One MW solar photovoltaic project at Buckley AFB, CO.
- 2.3 MW landfill gas generation plant at Hill AFB, UT, and 7 MW landfill gas generation plant at Joint Base Elmendorf Richardson-Richardson, AK.
- 10 MW solar photovoltaic array at Luke AFB, AZ.
- 20 MW solar photovoltaic array at Air Force Plant 42, Palmdale, CA.

Ground Source Heat Pump (GSHP) projects within the Air Force have a 11,277 ton total operating capacity which is equivalent to approximately 6,100 MWh resilient renewable energy. Ground Source Heat Pump projects were executed using various funding sources including Energy Savings Performance Contract, Utility Energy Service Contract and the Energy Resilience and Conservation Investment Program.

Defense Agencies

The Defense Agencies continue to implement renewable energy projects on their facilities. In many cases, Defense Agencies operate in individual buildings rather than campuses or installations, limiting their ability to implement renewable energy projects. However, Defense Agencies continue to consider cost-effective, small-scale, and distributed renewable energy generation. DLA renewable energy projects continue in spite of limited geographic locations and low cost of utilities often resulting in a lack of economic feasibility for most renewable energy options. Examples where progress was made include DLA Aviation Operations Center in Richmond, VA, and the new DLA Distribution Operations Center building at Susquehanna, PA. The Aviation Operations Center HVAC was designed to use of ground source heat pumps and the Distribution Operations Center has 130 kW solar panel system on the roof. In addition, construction of solar walls at both Susquehanna, PA, and San Joaquin, CA, have been completed.

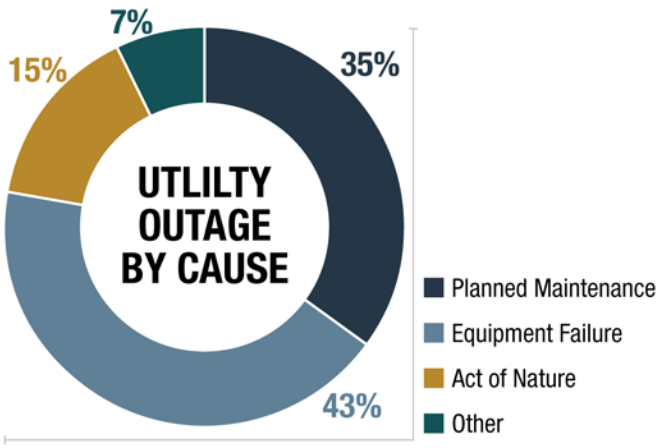
6. Reporting Utility Outages on Military Installations

Section 2925(a)(2) of title 10, U.S.C., requires the reporting of utility outages at military installations and in FY 2017 DoD Components reported approximately 1,205 utility outages that lasted eight hours or longer, an increase from the 507 events reported in FY 2016. Electrical disruptions account for the majority of these utility outages (72 percent). The increase in the number of reported events is primarily a result of higher incidence of reporting and is not indicative of a substantial increase in actual outage events lasting longer than eight hours.

Of the 1,205 reported outage events lasting longer than eight hours, the Services provided financial impacts for 274 of the events. The combined length of outages for these 274 events was 2,179.34 days; the estimated financial impact of these outages was $27,615,061 ($12,671 per outage day). In the utility and master planning communities, cost in dollars per kilowatt hour is the standard measurement used to distinguish the financial impacts of electric outages. DoD does not have the modeling capability in place to readily evaluate the outage data in accordance with this industry best practice. In FY 2018, DoD will continue to refine its outage data collection techniques and future Annual Energy Management Reports will reference the impact of outages accordingly.

As in previous years' reporting, in FY 2017, the mitigation efforts associated with DoD utility outages included upgrading infrastructure, increasing servicing efforts with the local utility, and pursuit of emergency or redundant power supplies such as backup generators. These utility outages were caused by acts of nature, equipment failure, or planned maintenance. In FY 2017, equipment failure (e.g., reliability or mechanical issues) accounted for 43 percent of the reported utility outages, 35 percent were caused by planned maintenance, and 15 percent outages were caused by acts of nature (e.g., weather, storms). The remaining seven percent were considered "other" since they did not fall under these categories (for example, vehicle accidents causing power outages or operator error).

Figure 6-1: FY 2017 Utility Outages by Cause



7. Additional Reporting Requirements

- Section 315, the National Defense Authorization Act (NDAA) for Fiscal Year 2017 (Pub. L. 114-328) (Appendix E)
    - Efforts to reduce the high energy costs on military installations
- Senate Report 115-125, to accompany S. 1519, the NDAA for FY 2018 (Appendix F)
    - Energy Savings Performance Contracts Assessment
    - Energy Assurance on Military Installations
- House Report 115-200, to accompany H.R. 2810, the NDAA for FY 2018 (Appendix G)
    - Energy Resilience of Overseas Military Installations
- House Report 115-219, to accompany H.R. 3219, Department of Defense Appropriations Bill for FY 2018 (Appendix H)
    - Energy Security of Overseas Military Installations
- Senate Report 114-237 & House Report 115-188, Water Report (Appendix I)

Appendix A - List of Energy Acronyms

Acronym	Definition
AEMRR	Annual Energy Management and Resilience Report
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFIMSC	Air Force Installation and Mission Support Center
AFV	Alternative Fuel Vehicle
ANGB	Air National Guard Base
ARNG	Army National Guard
ASA(EI&E)	Assistant Secretary of the Army for Installations, Energy and Environment
ASN(EI&E)	Assistant Secretary of the Navy for Energy, Installations and Environment
ASRA	Army Strategic Readiness Assessment
BBtu	Billion British Thermal Unit
Btu	British Thermal Unit
CNG	Compressed Natural Gas
CNIC	Commander, Navy Installations Command
CNO	Office of the Chief of Naval Operations
CO2e	Carbon Dioxide Equivalent
CONUS	Contiguous United States
DASA(E&S)	Deputy Assistant Secretary of the Army for Energy and Sustainability
DASN(Energy)	Deputy Assistant Secretary of the Navy for Energy
DC I&L	Deputy Commandant for Installations and Logistics
DCMA	Defense Contract Management Agency
DeCA	Defense Commissary Agency
DFAS	Defense Finance and Accounting Service
DIA	Defense Intelligence Agency
DLA	Defense Logistics Agency
DoD	Department of Defense
DoDI	Department of Defense Instruction
DOE	Department of Energy
DON	Department of the Navy
DUSD (I&E)	Deputy Under Secretary of Defense (Installations and Environment)
E85	85 percent ethanol fuel
EIA	Energy Information Administration
EISA	Energy Independence and Security Act
EO	Executive Order
EPAct	Energy Policy Act
ES^2	Energy Security and Sustainability
ERCIP	Energy Resilience Conservation Investment Program

Acronym	Definition
ESPC	Energy Savings Performance Contract
EUI	Energy Use Intensity
EV	Electric Vehicle
FRCS	Facility-Related Control Systems
FY	Fiscal Year
GGE	Gallons of Gasoline Equivalent
GHG	Greenhouse Gas
GSA	General Services Administration
GSF	Gross Square Foot
GSHP	Ground Source Heat Pump
HQ	Headquarters
HVAC	Heating, Ventilation, and Air Conditioning
IC	Intelligence Community
ILA	Industrial, Landscaping, and Agriculture
KW	Kilowatt, 1 thousand Watts
LPG	Liquefied Petroleum Gas
MCAGCC	Marine Corps Air Ground Combat Center
MCICOM	Marine Corps Installations Command
MCICOM GF	Marine Corps Installations Command, Director Facilities
MCICOM GF-1	Marine Corps Installations Command, Energy and Facilities Operations Section
MDA	Missile Defense Agency
MGal	Million Gallons
MILCON	Military Construction
MIT-LL	Massachusetts Institute of Technology – Lincoln Laboratory
MSW	Municipal Solid Waste
MW	Megawatt, 1 million Watts
MWh	Megawatt-Hour, 1 million Watt-hours
NAS	Naval Air Station
NAVFAC	Naval Facilities Engineering Command
NDAA	National Defense Authorization Act
NECPA	National Energy Conservation Policy Act
NGA	National Geospatial Intelligence Agency
NRO	National Reconnaissance Office
NSA	National Security Agency
NSA	Naval Supply Activity
NTV	Non-Tactical Vehicle
O&M	Operations and Maintenance
OACSIM	Office of the Assistant Chief of Staff for Installation Management
OASD(EI&E)	Office of the Assistant Secretary of Defense for Energy, Installations, and Environment
ODASD(IE)	Office of the Deputy Assistant Secretary of Defense for Installation Energy

Acronym	Definition
OPNAV-N46	CNO Shore Installation Management Division
PEV	Plug-in Electric Vehicle
PPA	Power Purchase Agreement
PV	Photovoltaic
REC	Renewable Energy Credit
SAF/IE	Deputy Assistant Secretary of the Air Force for Energy
SESC	Senior Energy and Sustainability Council
SMR	Small Modular Reactor
SRM	Sustainment, Restoration, and Modernization
SSPP	Strategic Sustainability Performance Plan
UESC	Utility Energy Services Contract
UFC	Unified Facilities Criteria
UP	Utilities Privatization
U.S.	United States
U.S.C	United States Code
USC	Utility Service Contract
VAM	Vehicle Allocation Methodology
WHS	Washington Headquarters Service

Appendix B - Compliance Matrix

	Subsection / Paragraph	Description	FY 2017 AEMRR Chapter / Appendix	Page Number
10 USC § 2925	**(a)**	**Annual Report Related to Installations Energy Management.** Not later than 120 days after the end of each fiscal year, the Secretary of Defense shall submit to the congressional defense committees an installation energy report detailing the fulfillment during that fiscal year of the energy performance goals for the Department of Defense under section 2911 of this title. Each report shall contain the following:		
	(a)(1)	A description of the progress made to achieve the goals of the Energy Policy Act of 2005 (Public Law 109–58), section 2911(g) of this title, section 553 of the National Energy Conservation Policy Act (42 U.S.C. 8259b), the Energy Independence and Security Act of 2007 (Public Law 110–140), and the energy performance goals for the Department of Defense during the preceding fiscal year.	**4,5**	10-31
	(a)(2)	A description of the energy savings, return on investment, and enhancements to mission assurance realized by the fulfillment of the goals described in paragraph (1).	**3,4,5**	8-31
	(a)(3)	Details of all commercial utility outages caused by threats and those caused by hazards at military installations that last eight hours or longer, whether or not the outage was mitigated by backup power, including non-commercial utility outages and Department of Defense-owned infrastructure, including the total number and location of outages, the financial impact of the outages, and measure taken to mitigate outages in the future at the affected locations and across the Department of Defense.	**6**	31
10 USC § 2911	(a)(1)	Energy Performance Goals. The DoD shall submit to the congressional defense committees the energy performance goals for the Department of Defense regarding transportation systems, support systems, utilities, and infrastructure and facilities.	**Appendix C**	C-1
	(b)(1)	Energy Performance Master Plan. The DoD shall develop a comprehensive master plan for the achievement of the energy performance goals of the Department of Defense, as set forth in laws, executive orders, and Department of Defense policies.	**Appendix C**	C-1
	(e)(2)	Interim Renewable Energy Goal. Requires the DoD to establish an interim FY 2018 goal for the production or procurement of facility energy from renewable sources.	**Appendix C**	C-1
P.L. 114-328, NDAA FY 2017 (S. 2943 Sec. 315)	p.	The Senate Armed Services Committee directed the Under Secretary of Defense for Acquisition, Technology, and Logistics to report to Congress on efforts to achieve cost savings at military installations with high levels of energy intensity.	**Appendix E**	E-1

	Subsection / Paragraph	Description	FY 2017 AEMRR Chapter / Appendix	Page Number
NDAA FY 2018 (Senate Report 115-125)	p. 106	In order to assess the current statutory authorities and their appropriateness and flexibility to support energy resilience on military installations, the Secreatary of Defense is directed to report to the defense committees within 180 days of enactment of this Act the following: (1) authorities used in award of energy resilience projects during fiscal years 2015-2017 and (2) challenges experienced during fiscal years 2015-2017 in the execution of energy resilience projects due to limitations in existing statutory authorities.	**Appendix F**	F-1
NDAA FY 2018 (Senate Report 115-125)	p. 107	The committee directs the Secretary of Defense to provide an assessment to the congressional defense committees no later than 90 days after the date of enactment of this Act. The assessment shall include but not limited to: (1) recommendations on the use of energy savings performance contracts (ESPCs) for savings achieved through training improvements; (2) identification of potential savings that could be achieved through improvements to training; (3) pros and cons of using those savings as part of a long term ESPC; (4) any new authorities that would be needed if a decision was made to use savings as part of additional ESPC; and (5) any other recommendations deemed appropriate.	**Appendix F**	F-1
NDAA FY 2018 (House Report 115-200)	p. 92	The "committee directs the Secretary of Defense to provide a breifing to the House Committee on Armed Services by March 1, 2018, on potential vulnerabilities to energy supply disruptions at overseas locations that host permenant and rotational U.S. Armed Forces and on mitigation efforts aimed at protecting mission resiliency. The briefing must, at a minimum, assess the operational risk of energy supply disruptions, identify mitigation measures to sustain mission-critical operations, and assess the feasibility and cost and schedule impactes including diversified energy solutions for future overseas military construction projects."	**Appendix G**	G-1
FY 2018 HAC-D, House Report 115-219	p. 60	The House Armed Services Committee directed the Secretary of Defense to submit a report to the congressional defense committees not later than January 9, 2018 on the potential vulnerabilities of energy supply disruptions at overseas locations hosting permanent and rotational United States armed forces, inculding medical centers on military installations, and efforts the Department is currently taking to mitigate the risk of potential energy supply disruptions at overseas military installations, including considerations the Department is taking to mitigate such risks when reviewing energy supply options at such installations.	**Appendix H**	H-1

	Subsection / Paragraph	Description	FY 2017 AEMRR Chapter / Appendix	Page Number
S.2806 (Senate Report 114-237)	p. 9	To assess the current status of water demand and potential water conservation opportunities across U.S. military installations, the Secretary of Defense is directed to report to the Committees on Appropriations of both Houses of Congress within 180 days of enactment of this act the following: (1) the current water usage on military installations; (2) the vulnerability of each military installation to water scarcity; and, (3) the water conservation potential according to (a) reduced water use and (b) cost savings if current water conservation technologies and efficient design were implemented at military installations.	**Appendix I**	I-1
H.R. 2998 (House Report 115-188)	p. 23	To assess the current status of water demand and potential water conservation opportunities across U.S. military installations, the Secretary of Defense is directed to report to the Committees on Appropriations of both Houses of Congress within 180 days of enactment of this act the following: (1) the current water usage on military installations; (2) the vulnerability of each military installation to water scarcity; and, (3) the water conservation potential according to (a) reduced water use and (b) cost savings if current water conservation technologies and efficient design were implemented at military installations.	**Appendix I**	I-1

Appendix C - Energy Performance Master Plan

DoD Energy Performance Master Plan

Introduction

> Installation energy is the energy necessary to support the functions of over 500 fixed installations on nearly 29 million acres of land within the United States and internationally. This energy is distinct from operational energy, which consists largely of mobility fuel that is used by operational aircraft, ships, and tanks, as well as generators at forward operating bases.

The Energy Performance Master Plan (hereafter referred to as Master Plan) aligns investments to installation energy objectives, enables consistent Department-wide decision-making, and establishes metrics to evaluate DoD's progress against installation energy performance goals. The Master Plan was established and reported in the FY 2011 AEMR. The goals outlined in the Master Plan align with the Department's facility energy strategy designed to reduce energy costs and improve the energy resilience of fixed installations. The key elements of the installation energy strategy are (Figure C-1):

- Maximize Efficient Energy Use
- Expand Supply for Mission Assurance
- Enhance Energy Resilience

Figure C-1: Installation Energy Approach

In FY 2011, the then Office of the Deputy Under Secretary of Defense for Installations and Environment (ODUSD(I&E)) developed its energy performance goals and its first Master Plan with input from DoD Components. The Office of the Assistance Secretary of Defense for Sustainment (OASD(S)) is in the process of updating the Master Plan to meet the emerging energy requirements and to address energy security challenges specified in the Secretary of Defense's National Defense Strategy (NDS) released in February 2018. The energy performance goals will be updated and reported annually, while the Master Plan will be updated periodically in the AEMRR. However, DoD Components are required to submit their facility energy investment projections for the Future Years Defense Program (FYDP) as part of their Master Plan submittal. The DoD Components' submissions to the President Budget, investment profile, energy benefit analyses, and narratives will be the basis for any periodic updates of the Master Plan within the AEMRR.

Energy Performance Goals

The DoD energy goals in Tables C-1 and C-2 were set forth by title 10, U.S.C., section 2911(e) and the Energy Independence and Security Act of 2007 (EISA 2007). The energy efficiency goals established by E.O. 13693 (and reported in the previous report) were rescinded by E.O. 13834. The Department remains committed to maximizing the efficient use of energy to free up resources for higher priorities. However, as the DoD deploys new weapon systems and technology to increase military readiness and lethality as directed in the NDS, a rise in energy demand could occur and subsequently reduce energy efficiency results. With respect to renewable energy, the DoD strives to optimize the use of on-site distributed energy resources from all sources of energy generation to directly improve mission assurance. The type of source is determined by local availability, market conditions, a business case, or mission requirements. As such, the Department is committed to optimizing the effective and efficient use of generating sources. As of the writing of this report, there are no discreet statutory goals related to energy resilience. Such goals have been requested, and once established, DoD will add these metrics into the Energy Performance Master Plan.

Table C-1: DoD Energy Performance Goals

Goal	Description	Uniform Measure	Method of Measurement	Metric
Optimize Use of Renewable Energy	Increase deployment of on-base renewable energy to improve energy resilience.	Electric and non-electric renewable energy production and procurement.	Electric and non-electric renewable energy produced or procured compared to electricity consumption.	Billion Btu (BBtu)
Decrease Petroleum Consumption	Decrease petroleum consumption in fleet vehicles.	Fleet vehicle petroleum consumption.[1]	Fleet vehicle petroleum consumption reduction.	Gallons of gasoline Equivalent (GGE)
[1]Petroleum includes gasoline, diesel, and the diesel portion of biodiesel (B20).				

Table C-2: Energy Performance Targets

Target	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY25
Renewable Energy[1]	-	-	-	-	-	-	-	+15%	-	-	+25%
Petroleum Consumption[2]	-12%	-14%	-16%	-18%	-20%	-22%	-24%	-26%	-28%	-30%	-
[1]FY18 interim target required by 10 USC 2911(e) **[2]Required by EISA 2007, reduction targets are compared to 2005 baseline.**											

DoD will update this Master Plan periodically to address new information, changes in energy performance goals, and to identify the investments necessary to achieve those goals. DoD's commitment to the energy performance goals also includes compliance with energy statutes, regulations, and EOs. Accordingly, the energy performance goals continue to advance the DoD facility energy mission, vision, and strategy.

Appendix D - DoD Energy Performance Summary

Goal Performance

Energy Management Requirements	Baseline in Btu/GSF	FY 2017 Btu/GSF	Percent Change Baseline - FY 2017	FY 2017 Goal Target vs. Baseline
Reduction in energy intensity in facilities subject to E.O. 13693 goal based on FY15 baseline	98,021	91,714	-6.4%	-5.0%
Reduction in energy intensity in facilities for agencies qualified to use alternative energy intensity goal based on FY2003 baseline	N/A	N/A	N/A	N/A

Renewable Electric Energy Requirement	Renewable Electricity Use (MWH)	Total Electricity Use (MWH)	Percentage of Facility Electric Use	FY 2017 Goal Target
Eligible renewable electricity use as a percentage of total electricity use	1,789,494.5	30,136,791.2	**5.9%**	10.0%

Clean Energy Requirement	Clean Energy Use (MMBTUs)	Total Facility Energy Use (MMBTUs)	Percentage of Facility Energy Use	FY 2017 Goal Target
Eligible renewable electricity plus alternative energy as a percentage of total facility energy use	31,356,565.5	198,541,433.1	**15.8%**	10.0%

Water Reduction Goals	Baseline	FY 2017	Baseline to FY 2017	FY 2017 Goal Target
Reduction in potable water consumption intensity (2007 gal per gsf Baseline)	59.6	43.6	-26.9%	18.0%
ILA/Non-Potable Freshwater (2010 thou. Gal Baseline)	11,810.300.00	7,205,551.4	-39.0%	12.0%

Metering Goals	Cumulative # of Buildings	Cumulative % of Appropriate	Cumulative # of Buildings Metered	Cumulative % of Appropriate Buildings	Cumulative # of Buildings	Cumulative % of Appropriate
Standard Meters in FY 2016	10,570	20.3%	4,410	24.5%	726	22.9%
Advanced Meters in FY 2016	25,849	49.6%	5,057	28.1%	605	19.1%
Total Meters in FY 2016	36,419	69.9%	9,467	52.6%	1,331	42.0%

Federal Building Energy Efficiency Standards	Percent of New Building Designs	Compliance Target
Percent of new building designs started since beginning in FY 2007 that are 30 percent more energy efficient than relevant code, where life-cycle cost effective (including 8/2012 standards)	66%	100%

Investments in Energy and Water Management

Sources of Investment	Investment Value (Thou. $)	Anticipated Annual Savings (MMBTUs)
Direct obligations for facility energy efficiency improvements	$237,549.6	450,109.4
Investment value of ESPC Task/Delivery Orders awarded in fiscal year	$727,815.3	7,174,829.0
Investment value of UESC Task/Delivery Orders awarded in fiscal year	$70,665.5	135,429.0
TOTAL	**$1,036,030.4**	**7,760,367.4**

	Percent
Total Investment as a percentage of total facility energy cost	31.2%
Financed (ESPC/UESC) investment as a percentage of total facility energy costs	24.1%

NECPA/EISA Energy Goal Subject Building		
Energy Type	BBTUs	Cost (thou.)
Electricity	93,509.7	$ 2,265,600.9
Fuel Oil	13,467.7	$ 235,632.4
Natural Gas	62,924.1	$ 393,729.2
LPG	886.7	$ 11,400.1
Coal	9,081.6	$ 41,533.0
Steam	4,357.5	$ 105,693.0
Other	628.1	$ 8,099.9
Renewable Electric, On-site	2706.1	$ 10,012.0
Renewable Electric Off-Site	784.3	$ 13,902.0
Renewable, Other, On-Site	408.5	$ 914.2
Renewable, Off-Site Green Energy Purchases	719.8	$ 15,261.0
TOTAL	**189,474.2**	**$ 3,101,777.7**
Goal Subject Buildings GSF		1,884,158.1
BTU/GSF		100,562
Source Energy Savings Credit (BBTU)		-13,103.5
BTU/GSF w/RE Source BTU Credit		91,714

NECPA/EISA Energy Goal Excluded Buildings		
Energy Type	BBTUs	Cost (thou. $)
Electricity	7,686.4	$ 192,978.3
Fuel Oil	179.0	$ 1,938.5
Natural Gas	601.4	$ 2,562.7
LPG	0.0	$ 0.0
Coal	0.0	$ 0.0
Steam	134.7	$ 3,519.4
Other	0.0	$ 0.0
Renewable Electric, On-site	28.6	$ 0.0
Renewable Electric Off-Site	**0.0**	**$0.0**
Renewable, Other, On-Site	437.1	$ 0.0
Renewable, Off-Site Green Energy Purchases	0.0	$0.0
TOTAL	**9,067.1**	**$ 200,998.9**
Goal Subject Buildings GSF		9,187.0
BTU/GSF		986,955.9
Source Energy Savings Credit (BBTU)		-742.7
BTU/GSF w/RE Source BTU Credit		906,114.0

Appendix E - Section 315, P.L. 114-328 (S 2943), the National Defense Authorization Act (NDAA) for FY 2017

Efforts to reduce the high energy costs on military installations

SUMMARY

10 U.S.C. §2911(a) states that the energy policy of the United States "…shall ensure the readiness of the armed forces for their military missions by pursuing energy security and energy resilience." The two definitions of critical importance to the Department of Defense (DoD) energy policy are outlined in 10 U.S.C. §101(e). First, "…the term 'energy resilience' means 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 task critical assets and other mission essential operations related to readiness, and to execute or rapidly reestablish mission essential requirements." Second, "…the "term 'energy security' means having assured access to reliable supplies of energy and the ability to protect and deliver sufficient energy to meet mission essential requirements."

Outside of DoD, resilience is often defined as the opposite of efficiency; efficiency creates ideal operation within a very narrow scope of conditions, while resilience expands the capability of a system to operate across a variety of conditions, absorb disruptions and adapt to a changing environment. The DoD installation energy enterprise, however, does not exist in an abstract thought experiment; it is a multi-billion dollar enterprise that that must provide power to DoD missions operating out of more than 400 installations around the globe. In this environment, reducing consumption and increasing efficiencies actually contributes to the resilience of system so long as the tactics are employed with consideration toward resilience. DoD is able to balance these simultaneous requirements by leveraging strategies that target specific energy efficiency and consumption reduction measures that support, rather than detract from, the pursuit of energy resilience and energy security.

The remainder of this Summary outlines the Department's efforts to reduce energy consumption and costs on installations across the enterprise. Following that, Sections (A)-(F) address the specific concerns raised by Congress in Section 315, P.L. 114-328 (S 2943), the National Defense Authorization Act (NDAA) for FY 2017.

Department of Defense (DoD) Energy Costs and Consumption, 1975-2017

Since 1975, on the aggregate, the Department has reduced its energy consumption, increased the efficiency of its energy infrastructure, and decreased the costs of providing power to Department's Military Components and the Defense Agencies. These efforts continue today with the express purpose of creating an environment where the rising costs of energy and the increasing demand required to meet critical mission requirements do not create a 'must-pay' burden that has a negative impact on DoD installations' ability to enable mission readiness.

In 1975, the federal government's energy consumption was 1,565,000 Billion Btus (BBtu); DoD accounted for 1,360,200 BBtus (or 86.9 percent) of the total. The total cost of energy consumption for DoD was $11.59 billion, or 83 percent of the federal government's $13.96 billion total

consumption bill. By FY 2016, DoD reduced its consumption to 709,200 BBtus, a 47.9 percent reduction in consumption, although its costs rose to $12.56 billion, a 8.4 percent increase.

In 1975, DoD installations accounted for 32.3 percent (439,200 BBtus) of DoD's total consumption and 36.5 percent of the total cost ($4.23 billion). By FY 2016, DoD installations reduced consumption to 198,031 BBtus, a 54.9 percent reduction, and costs to $3.5 billion, a 17.3 percent reduction. However, due to the rising costs of energy, DoD's cost per BBtu has risen from $0.96/BBtu to $1.77/BBtu, representing a 83.4 percent increase in per BBtu cost. Figure E-2[17] below depicts the contrast of decreasing consumption as compared to the increasing cost per BBtu for DoD installations, as well as DoD as a whole.

Figure E-1: DoD Consumption and $/MMBtu, 1975-2016

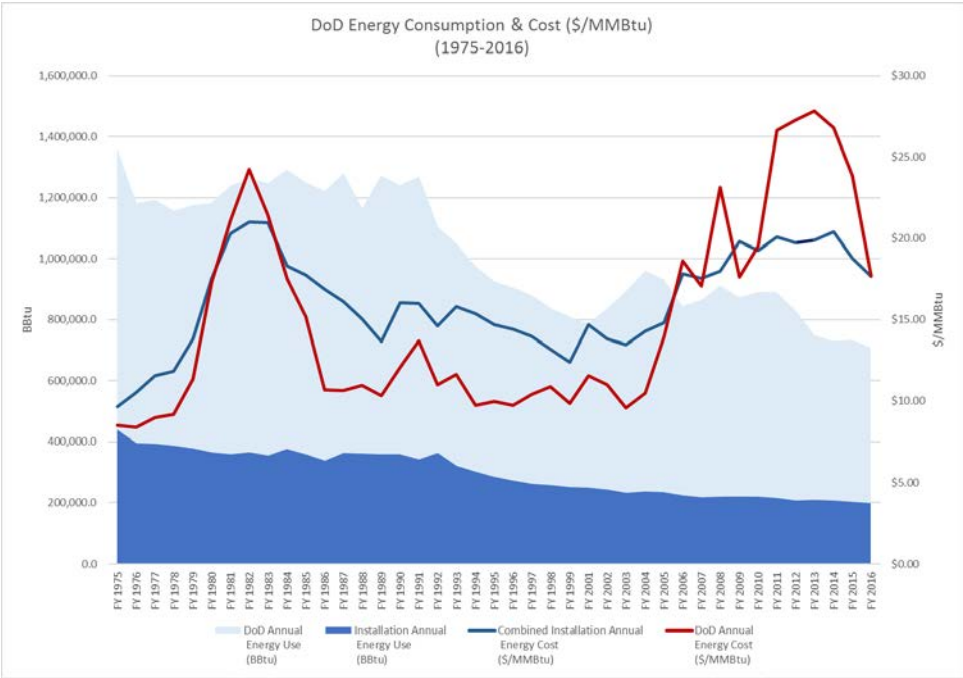
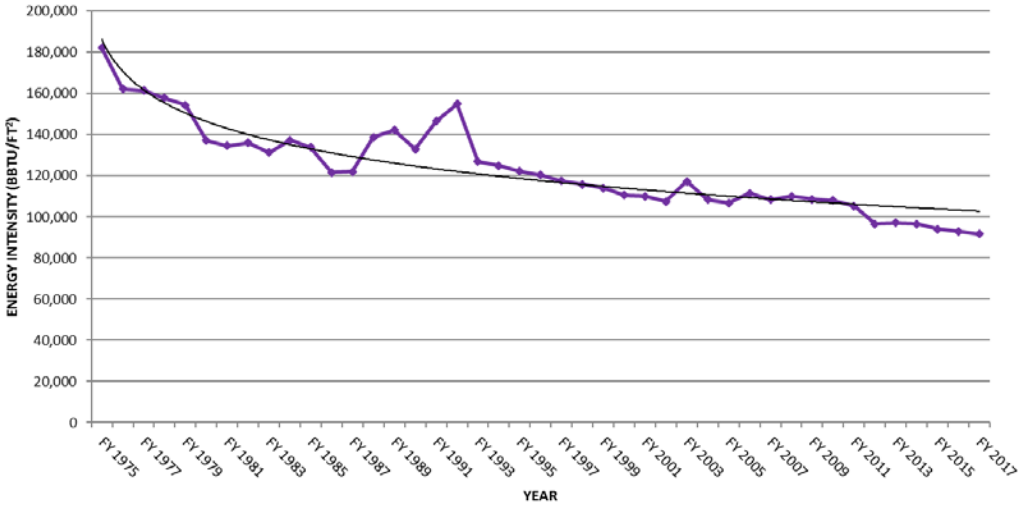


Table E-3 shows the Department's decrease in energy consumption per square foot (Energy Intensity); the figure depicts a drop in intensity from 182,153 BBtus/ft ^{2} in FY 1975 to 97,714 BBtus/ft^2 in FY 2017, a 49.7 percent reduction (which parallel's DoD's nearly 55 percent reduction in consumption during the same period).

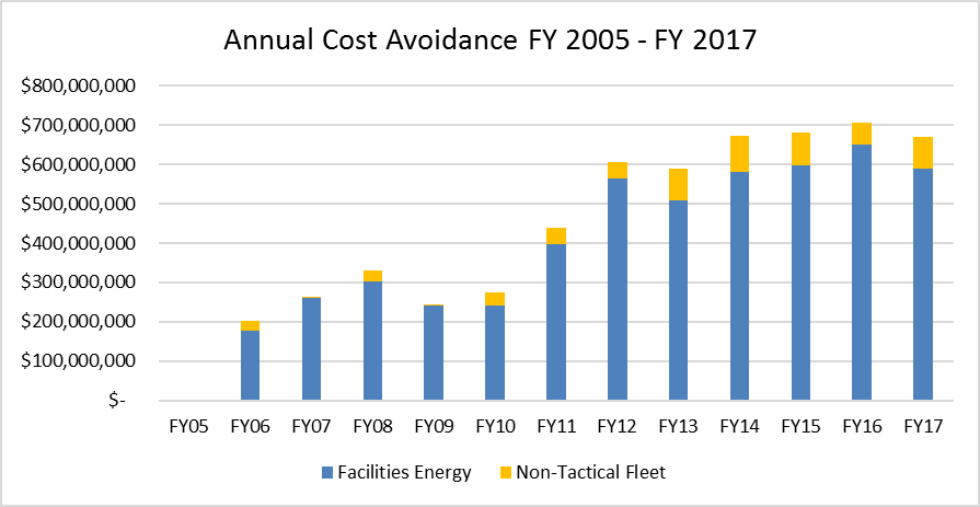
[17] Department of Energy (DOE), Federal Facility Reporting and Data, Comprehensive Annual Energy Data and Sustainability Performance, Table A-7: Energy Cost Metrics for Federal Facilities By Agency; found at: http://ctsedwweb.ee.doe.gov/Annual/Report/Report.aspx (accessed on 18 June 2018).

Figure E-2: DoD Installation Energy Intensity (1975-2017)



In FY 2017, the Department spent $3.3 billion on installation (stationary combustion) energy and $178 million on fuels to power its non-tactical vehicle (NTV) fleet for a total of $3.48 billion; the Department consumed a total 207,306 BBtus (198,541 BBtu for buildings and 8,764 BBtu in NTVs). Although FY 2017 saw a 0.3 percent increase from FY 2016, overall, FY 2017 consumption was reflective of a trend of reduction, 54.8 percent less than 1975 consumption levels and the second lowest consumption total during the same period. Beginning in FY 2007, in accordance with the metrics put forth in EISA 2007, the Department has calculated estimated energy and costs savings in comparison to the FY 2005 baselines. Incorporating FY 2017 values, the Department calculates a $5.11 billion savings in installation energy and more than $563 million in savings for NTVs against FY 2005 baselines ($5.67 billion total since FY 2005).

Figure E-3: DoD Cost Avoidance



Tools, Techniques, & Procedures to Reduce Cost and Consumption

DoD leverages a variety of strategies that have differing impacts toward reductions, ranging from longer-term sustained, cumulative impacts such as replacing aging equipment with new, more efficient equipment and behavior change campaigns to more aggressive tactics with immediate impacts such as leveraging different, more efficient power generation technologies and sources at more energy intensive installations. For instance, the Energy Independence and Security Act of 2007 (EISA 2007) outlined a variety of statutory requirements to incorporate more efficient technologies and more diverse power sources. In large part due to these requirements, since the passage of EISA 2007, DoD has reduced consumption by 7.6 percent or more than 15,600 BBtu, relative to FY 2005 baselines. The Department leverages three primary, broad tools to accomplish reductions in costs and consumption while still meeting the 10 U.S.C. §2911 energy policy requirement to support mission assurance and readiness: Policy, MILCON Investment, and Non-Federal Investment.

Policy

Policy, regardless of whether it is developed within the Office of the Secretary of Defense (OSD), at the Service-level, or on individual installations, is the most flexible, responsive tool available to shape how the Department uses energy. At the Department-level, DoD has multiple, current policy and guidance documents that address energy use.

DoD Instruction (DoDI) 4170.11, updated on March 16, 2016, "Installation Energy Management", provides the Department with guidance to reduce energy consumption and further invest in energy reduction measures to leverage our finite energy resources in a manner that make good business sense, but still supports readiness, efforts to realign the Department's focus on near-peer adversaries, and protection of the homeland. Specifically DoDI 4170.11 sets forth instructions on energy use awareness campaigns; energy and water project development, execution and financing; energy resilience, in accordance FY 2016 changes to Title 10 definitions; efficiency measures; and utilities privatization (UP).

In 2016, OASD(EI&E) also released an Installation Energy Plan memorandum that set forth guidance for installations to implement more structured processes for developing and tracking their respective energy plans. This memorandum was updated on May 30, 2018 to includes an expanded requirement to include all DoD installations; clarifies energy resilience requirements; clarifies cybersecurity requirements; and outlines an implementation framework for installations to complete their IEP based on the Deputy Assistant Secretary of Defense, Defense Continuity and Mission Assurance (DASD(DC&MA)) priority installations.

On March 17, 2017, the Department released guidance that specifically targets how installations maintain their energy infrastructure to ensure systems are operating effectively and supporting resilience. "Energy Resilience: Operations, Maintenance, & Testing (OM&T) Strategy and Implementation Guidance" was developed to assist installation commanders, mission owners, operations and maintenance staff, utility managers, energy managers, and other installation support personnel on DoD installations and at facilities to collaborate and ensure appropriate OM&T. The safety and reliability of an installation's power system largely depends on its OM&T strategy and effective OM&T programs can save between 5 and 20 percent on utility bills without the need for significant capital investment, while simultaneously costing approximately 20 times less than

retrofits.[18] More important, an effective OM&T program quantifies and mitigates risks in the power systems that could negatively impact mission readiness.

In addition to energy specific guidance, the Department also leverages a variety of other policies and guidance documents to inform operations that contribute to reducing the costs, particularly at those installations with higher energy requirements and/or in areas with higher utility costs. The Unified Facilities Criteria (UFC), developed internally by relevant stakeholders such as the Army Corps of Engineers, Naval Facilities Engineering Command, and Air Force Civil Engineering Center, provide planning, design, construction, sustainment, restoration, and modernization criteria that apply to DoD-owned and operated infrastructure (as well as infrastructure operating on DoD installations). Similar to the OM&T guidance referenced earlier, the UFC set forth practices that, in addition to providing for safety and security, encourage efficiencies that ultimately reduce the costs shouldered by installations to develop, operate, and maintain energy infrastructure, whether those operations are handled by the installation or a third-party stakeholder (e.g., local utility in a UP contract).

Installations also leverage applicable cyber security and mission assurance-related policy and guidance, such as DoD Directive (DoDD) 3020.40, Mission Assurance, DoDI 3020.45, Mission Assurance Construct, and OASD(EI&E) memorandum "Managing Cyber Risks to Facility-Related Control Systems" (dated March 31, 2016) to address the readiness and security of energy infrastructure at their respective installations. While cyber security and mission assurance policy may not, at first, seem to have practical application toward reducing the costs of operating and maintaining energy infrastructure, the unavoidable truth is that disruptions, whether caused by maintenance deficiencies or intentional attack by adversaries, are rarely characterized by low-cost impacts. A short duration disruption at a single installation can easily result in several thousands of dollars costs to repair faulty equipment or remove vegetation and larger disruptions that impact entire states and regions can result in multi-billion dollar impacts. The blackout that affected the Northeast and Southern Canada in 2003 cut power to more than 50,000,000 customers, caused a loss of 70,000 MW, cost between $4-10 billion, and is believed to have contributed to 11 deaths.

MILCON Investment

While the Department can use Congressional-appropriated Military Construction (MILCON) funds in multiple ways to develop and construct infrastructure that has a positive impact on the energy costs borne by fixed installations, the most flexible and frequently-used method employed by DoD is the "Energy Resiliency and Conservation Investment Program" (ERCIP). ERCIP has traditionally been used by installations to fund small projects that are forecast to provide substantial payback in reduced energy costs. ERCIP has grown from a $35 million program started in FY 2008 to address only energy conservation programs to a $150 million program that is now primarily intended to fund energy projects that can improve energy resilience, availability, reliability, and economic performance. The Department gives priority to projects to fund based on the criteria listed below. To be labeled as a priority, a project must:

[18] Sullivan G, R Pugh, AP Melendez, and WD Hunt. 2010. Operations & Maintenance Best Practices – A Guide to Achieving Operational Efficiency (Release 3). PNNL-19634, Pacific Northwest National Laboratory, Richland, WA.

a) Contribute to mission assurance at the specified installation or joint base and enhance energy resilience of mission critical functions;
b) Implement a documented energy plan for a given installation, region, department, or Component;
c) Integrate multiple energy/water savings, monitoring, renewable energy, or energy resilience/security technologies to realize synergistic benefits;
d) Implement a technology validated in a demonstration program (such as the Environmental Security Technology Certification Program (ESTCP) or other similar test bed programs) or an innovative technology that represents potentially significant improvement over existing technology; and
e) Dramatically reduce energy and water consumed at an individual installation or joint base.

The FY 2017 Report to Congress on the ERCIP program lists 40 projects across DoD that were funded in FY 2017. The average cost of a project was $3.7 million and the average project has a 7.7 year projected payback. Within ERCIP the average project savings-to-investment ratio (total savings over the lifetime of a project divided by upfront cost of investment) is 2.4; in other words, the average ERCIP project funded in FY 2017 is anticipated to generate nearly two and half times its initial investment in cost savings.

Non-Federal Investment

The Department increasingly relies on third-party financing mechanisms such as Utility Energy Service Contracts (UESCs) and Energy Savings Performance Contracts (ESPCs); Table E-1 summarizes the definitions of ESPCs and UESCs.

Funding Mechanism	Definition
Energy Savings Performance Contracts (ESPC)	An ESPC is a partnership between a Federal agency and an energy service company (ESCO). The ESCO conducts a comprehensive energy audit for the Federal facility and identifies improvements to save energy. In consultation with the Federal agency, the ESCO designs and constructs a project that meets the agency's needs and arranges the necessary funding. The ESCO guarantees that the improvements will generate energy cost savings sufficient to pay for the project over the term of the contract. After the contract ends, all additional cost savings accrue to the agency. Contract terms up to 25 years are allowed.
Utility Energy Service Contracts (UESC)	In a UESC, a utility arranges funding to cover the capital costs of the project, which are repaid over the contract term from cost savings generated by the energy efficiency measures. With this arrangement, agencies can implement energy improvements with no initial capital investment. The net cost to the Federal agency is minimal, and the agency saves time and resources by using the one-stop shopping provided by the utility.

Table E-1: ESPC and UESC Definitions

These financing vehicles allow DoD to implement energy efficiency, renewable, and distributed energy projects, as well as energy resilience projects without up-front appropriated funds. The

Federal Government repays the private capital over time using cost savings generated by the implemented projects. Since FY 2012, DoD has submitted more than $4.4 billion in non-governmental third-party financed ESPCs and UESCs, with $2.9 billion awarded through FY 2017. Nearly a quarter of that total was submitted for UESCs and ESPCs ($1,045,480,000) that are on installations on the ODASD(DC&MA) priority installation list.

DoD energy policy also continues to drive down energy costs, improve efficiencies, and reduce demand through adhere to intensity, efficiency and supply requirements in statutes such as the Environmental Protection Act of 2005 (EPA 2005), Energy Independence and Security Act of 2007 (EISA 2007), and National Energy Conservation Policy Act of 1978 (NECPA). DoD is able to balance these simultaneous requirements by leveraging comprehensive strategies that target specific energy efficiency and supply reduction measures which support, rather than detract from, the pursuit of energy resilience and energy security.

SECTION 315 (A) *A comprehensive, installation-specific assessment of feasible and mission-appropriate energy initiatives supporting energy production and consumption at military installations with high levels of energy intensity.*

DoD is focused on ensuring that military installations are prepared for and able to quickly recover from energy disruptions that impact mission assurance and readiness. This goal drives the Department's consolidated approach to improving and managing energy-related infrastructure across the entire enterprise. The foundation upon which these efforts are based is *missions determine requirements*; solutions for the energy infrastructure risks are specific to the missions themselves.

DoD has issued multiple guidance/policy documents since FY 2016 to guide this planning methodology, specifically:

- DoDI 4170.11 (dated March 16, 2016)
- Installation Energy Plans (IEPs) Guidance Memo (dated March 31, 2016)
- Energy Resilience: Operations, Maintenance, and Testing (OM&T) Strategy and Implementation Guidance (dated March 17, 2017)
- Energy Resilience and Conservation Investment Program Guidance (revised and published annually)

In addition to these previously published items, ODASD(IE) will also publish a specific Energy Resilience Guidance in FY 2018 and the Chairman of the Joint Chiefs of Staff (CJCS) will publish revised data collection requirements for power systems involved in mission assurance assessments. DoD anticipates that there two additional items will create better visibility for both mission owners and installations.

From the enterprise-level, these guidance documents address comprehensive methodologies for pursuing feasible and mission-appropriate energy initiatives that support efficient and cost-effective energy production and consumption at military installations with high levels of energy

intensity. The Military Departments are then able to leverage these policies to pursue tailored efforts specific to their requirements at the Service, regional, and installation levels.

To measure implementation, ODASD(IE) has initiated a series of on-site, installation-specific assessments that review the current status of infrastructure. The lessons learned in these site-specific assessments will be used to identify practices that apply across the entire enterprise, facilitate improvements, and decrease the burden of conducting assessments at all of DoD's more than 400 installations.

The list below outlines the methodology that was used to determine the initial assessment locations:

1. First, the top 20 percent of installations from each Service, based on intensity, were designated.
2. Next, installations not in the U.S. were withdrawn from consideration due to the limited control DoD has to influence infrastructure investment decisions at foreign locations.
3. Then all installations with annual energy costs below $2 million were removed from consideration.
4. Last, the list was consolidated with a list of installations that were previously identified by either the Services or OSD as priority installations.

Table E-1 demonstrates the values that resulted from each stage of the methodology; Table E-2 lists the final list of installations that resulted from consolidation with the critical installations the Services identified for assessment.

	USA	USAF	USN	USMC	TOTAL
All Installations	156	184	70	28	425
Top 20% Consumption	29	37	14	6	85
Installations in CONUS	17	22	4	4	45
In CONUS, >$2M+	4	21	2	2	21

Table E-2: Determination of Initial Assessment Locations (w/out Services' Critical Installation Input)

Installation	State
Fort Greely	Alaska
Joint Base Pearl Harbor-Hickam	Hawaii
Naval Submarine Base Kings Bay	Georgia
Fort Stewart	Georgia
Vandenberg AFB	California

Table E-3: Final Installation Assessment Locations

In addition, ODASD(IE) is leveraging information from critical mission energy resilience site assessments conducted by ODASE(IE), the Navy, and the Air Force. The primary lesson evident from these assessments is that stakeholders lack a fundamental awareness about what energy

resilience entails, and discussions between critical mission operators and the installation energy staff occur infrequently. The importance of addressing this misunderstanding cannot be overstated and will be addressed first before generating more specific recommendations to pursue on a large scale. The lack of understanding starts with the absence of the communication of mission power and energy requirements from the mission owners to the installation staff and is also well demonstrated by the prevalence of inadequate electrical system metering and inconsistencies in operations, maintenance, and testing practices. Until these deficiencies are addressed, any investments in other solutions will likely be ineffective or even actively detrimental to resilience at an installation.

The following sections provide more specific details regarding the insights gathered to date.

A.1 RESILIENCY AWARENESS

Energy directly enables missions and routine operations for all DoD operations, but is typically overlooked. Power outages can result in critical mission failures or delays through direct power loss (e.g. sensors, computing, communications), indirect power loss (e.g. maintenance, repairs, support staff), or impacts to critical personnel (e.g. lighting, closure of child daycare centers, food refrigeration failures, lack of water and wastewater treatment). As a result, most domestic installations and missions could be disabled via a physical or cyber-attack to the utility or base electrical generation or distribution systems.

A.1.1 Identification of Critical Loads

A complete list of load sizes and locations is essential to accurately size backup generation assets for critical loads, prioritize repairs during an outage, and identify unexpectedly large loads. While knowledge varied across mission and sites, mission owners on the installations visited rarely had this information. This challenge was compounded by a disparity in data available from installed advanced metering infrastructure (AMI) meters, as few were correctly installed with data available to mission owners and relevant installation personnel. As a result, backup generation assets are vastly oversized and often connected to non-critical loads, wasting valuable and limited maintenance and testing budgets and personnel time. If comprehensive data were available, better understanding of critical loads and the technologies that could address mission requirements would enable more cost-effective decisions and increase resources available for critical missions. The challenge is greater at Joint bases, as this communication is more challenging across Service boundaries.

A.1.2 Incomplete Electrical Documentation

In addition to challenges identifying loads, most mission owners were unfamiliar with electrical infrastructure, and most installations lacked complete, accurate, and regularly updated electrical system documentation. As single line diagrams show all electrical sources and the distribution network, and standard operating procedures identify hazards for specific equipment, this jeopardizes personnel safety and risks serious damage to the electrical system. Mission operation is also at risk, as unknown fuel storage quantities and refueling priorities could result in critical backup generators unexpectedly running out of fuel during a power outage. In addition, poor

documentation frequently results in deferred maintenance resulting from miscommunications within installation personnel or between the installation and the utility provider. Updates to this documentation must be done immediately to avoid serious delays to critical missions, and hazardous working conditions that could lead to serious injury or death.

A.2 RESILIENCY MAINTENANCE AND TESTING FOR POWER OUTAGES

Identifying and documenting loads, generation assets, and infrastructure must be completed in order to properly assess an installation's current resilience capabilities. Installations must then maintain assets and routinely and rigorously test their entire backup power systems under relevant conditions to ensure that everything will function as expected during a power outage. At most sites visited however, maintenance personnel were short-staffed and insufficiently funded (partly due to budgets based on outdated and incomplete documentation). The majority of backup generation units were oversized requiring additional maintenance and repair, and the large number of unnecessary generators serving non-critical loads often resulted in widespread deferment of testing and maintenance. In some cases, the lack of generator prioritization resulted in non-critical generators receiving maintenance, while critical generators were neglected for months or years.

When generators are tested, it is extremely rare for the testing to accurately assess readiness and is often counterproductive. While this varies between the Services, a common testing procedure found during assessments consisted of starting the generators without load and then idling them for 10-30 minutes before shut down. These tests do not provide any information into the ability of the system to automatically black start the generators, the status of the transfer switches, or the capacity to distribute power to loads. Furthermore, this type of testing results in wet stacking[19], increasing the risk that generators will fail during outage events.

At sites that require black start generator testing, it was not uncommon to find the requirement ignored by mission owners due to short-sighted assumptions about risk to mission with a full system test. When mission owners/back up power system operators choose to forgo system assessments during normal grid operations, failures and deficiencies in the systems will likely not be detected until a real, unplanned disruption occurs. Until this mindset is changed, these missions will be unprepared for power disruptions that can easily degrade and/or eliminate critical capabilities.

[19] *Wet stacking* refers to a condition in diesel engines when unburned fuel passes into and collects in the exhaust system. This can result in fouled injectors and a buildup of carbon on exhaust values, turbo chargers, and exhaust, leading to a loss in engine performance. While the impacts are often negligible over the short term, over the long term the deposits can scar and erode critical engine surfaces, leading to severe degradation of load capacity.

SECTION 315 (B) *An assessment of current sources of energy in areas with high energy costs and potential future sources that are technologically feasible, cost-effective, and mission appropriate for military installations.*

As discussed in Section 315(A), *missions determine requirements* and the solutions for the energy infrastructure risks are specific to the missions supported by the infrastructure. In this construct, the Department, from the enterprise to the installation level, continually evaluates what technologies are available and applicable to address the scope of missions that are assigned to DoD operational forces.

A wide variety of energy technologies have the potential to provide resilient backup or prime energy generation. These range from small backup generation units to microgrids, large scale solar photovoltaic arrays, energy storage systems, and co-generation plants. However, implementing solutions that actually meet mission requirements is not as simple as choosing the latest efficient technology. Unfortunately, in the present environment, the typical energy posture often favors the newest, largest technologies available and fails to recognize the necessity of both properly sizing assets to requirements and accounting for maintenance and testing. In addition, as complexity increases and technologies are less established, repairs become more specialized, expensive, and time intensive. Installation personnel and local contracting companies must have the requisite knowledge and parts to repair any power system deployed to support critical missions, especially for remote installations.

In FY 2018 DoD will release a comprehensive resilience strategy that includes modeling capabilities that the Services can leverage to determine the best fit for their mission specific requirements. The modeling capability, called the Energy Resilience Assessment (ERA) Tool, uses industry-standard analytical methodologies to assess potential energy infrastructure architectures at installations. The output of the assessment provides decision makers with specific recommendations for each installation ranked by cost and impact on resilience.

The following sections provide a brief overview of the various solutions that are either already implemented or are under consideration at installations across DoD.

B.1 Backup Generators

Diesel generators dominate backup power needs across all installations and can provide a reliable power source if sufficiently maintained and fueled. Uninterruptable power supplies are also commonly used to bridge the generator startup time for critical loads that cannot experience brief power outages. Many installations would both increase resiliency and save costs by removing generators connected to non-critical loads, clustering critical loads to consolidate generation when oversized units have been installed, and performing adequate testing as described above.

B.2 Microgrids

Once the fundamental resilience baseline previously described is implemented, other energy technologies enabled by a microgrid can be considered to further increase resilience (and in some cases, reduce expenses). Microgrids allow multiple power sources to be connected through the

power distribution system, while allowing the installation to isolate, or island, its power system. Depending on the microgrid architecture, they can also maintain power with outages at one or more power sources, assuming functional capacity is still sufficient, or loads are appropriately prioritized. They can also save fuel by only running the generation assets required to meet the current or expected loads, though this functionality requires an understanding of installations loads and some advanced planning for large load swings. There are a few examples of long-established and successful microgrids at DoD installations (NBGTS Finegayan, Guam; the Marine Corps Air and Ground Combat Center (MCAGCC) Twentynine Palms, CA), however cooperation with local utilities, customized engineering to match operation requirements, and large capital investments are required.

B.3 Distributed Power Generation and Energy Storage

Installations in locations with significant solar or wind resources can consider adding renewable energy sources that should operate in an islandable mode when the main utility grid has failed to reduce fuel consumption. Well located solar photovoltaic (PV) arrays or wind farms in combination with an islandable inverter can produce significant power without requiring a fuel supply chain. As solar and wind power is intermittent, however, significant penetration of renewable power typically requires large energy storage systems. While energy storage can increase grid reliability and smooth power fluctuations, round trip efficiency will increase total energy used on site and add capital and maintenance expenses. However, much of the existing deployed solar PV is installed without islanding capability, preventing use as a backup generation asset.

B.4 Prime Power Generation and Natural Gas

Prime power co-generation plants can provide much or all of an installations' electricity requirements. These plants may be cost effective where natural gas prices are low and grid power prices are high, but will incur a significant capital expense and require a designated staff to operate and maintain them. When an integrated natural gas pipeline is available, multi-fueled backup generators should also be considered. This will not only minimize the on-base main fuel storage requirement, but also enable the installation to continue operations in the event of an extended outage that has disrupted the external liquid fuel supply chain.

B.5 Developing Technologies

Other new energy technologies (e.g. fuel cells, flywheels, advanced microgrids, etc.) may have a significant future impact for energy resilience. While DoD funding should continue to be allocated for research and development, these systems must be thoroughly tested at designated testbeds before wide scale integration. Premature rollout is extremely expensive and resource intensive and is likely to fail quickly, increasing the possibility of residual damage to the installation and power distribution system.

Recently small and very small modular nuclear reactors (SMRs and vSMRs, respectively) have received substantial attention from both industry and government stakeholders. This technology is still very early in development and DoD will continue to monitor its progress. Like with many

other new technologies, external partners can provide significant resources and expertise to the Department from development to deployment.

SECTION 315 (C) *A comprehensive implementation strategy to include required investment for feasible energy efficiency options determined to be the most beneficial and cost effective, where appropriate, and consistent with Department of Defense priorities.*

10 U.S.C. §2911(d) requires that DoD develop and implement "a comprehensive master plan for the achievement of the energy performance goals of the [DoD], as set forth in laws, executive orders, and [DoD] policies." Each year the Department publishes that master plan in the appendices of its Annual Energy Management Report (AEMRR). The actions set forth in that master plan are bolstered by additional policies and guidance published by ODASD(E) and other relevant policy offices in OSD. In keeping with the necessity to pursue an energy secure and energy resilient enterprise, DoD has published a variety of policies and guidance that provide additional instruction to the Services about implementing strategies in installation energy. These include:

- DoDI 4170.11 (dated 11 March, 2016)
- IEP Guidance (dated 31 March, 2016)
- Annual ERCIP Guidance (FY 2017, FY 2018, FY 2019)
- OM&T Guidance (dated 17 March, 2017)
- Utilities Privatization Guidance (TBD)
- Energy Resilience Guidance (TBD)

The policies and guidance documents provide the Services with detailed instructions on best practices to implement the broader strategies of master planning in alignment with efforts to develop energy resilience on the Department's installations. The intent of these additional policies and guidance is three-part:

1. First, create the framework for installations to build resilience into their installation energy planning (FY 2016-2018).
2. Second, create an environment where Service and OSD leadership can review the strategies in a consistent basis and, when applicable, push best practices out to the installations (FY 2018-2020).
3. Third, lay the groundwork for the installation energy plans to provide more direct input in the generation of comprehensive installation-wide master planning (FY 2020 onward).

Throughout the entire process of bringing resilience into DoD's mindset toward energy, ODASD(E) will also be conducting installation on-site assessments of energy infrastructure to build up a library of best practices and opportunities that can be applied across the enterprise.

While DoD may continue to update the existing master plan and related policies and guidance, DoD does not have any plans to whole-scale revise the master planning guidance related to energy infrastructure in a manner that provides specific solutions requirements for installations as a whole.

This aligns to DoD policy stating that resilience solutions are specific to the mission requirements and that each installation (or regional command) must work directly with mission, capability, and asset owners to build out solutions that are tailored to the specific requirements of the relevant mission(s).

SECTION 315 (D) *An explanation of how military services are working collaboratively in order to leverage lessons learned on potential energy efficiency solutions.*

OSD typically provides overall guidance and direction, while allowing individual Services the flexibility to implement the requirements in a manner best tailored to individual missions and environments. The current structure within the Department facilitates broad communication and cooperation between the Services on energy infrastructure efficiency solutions.

At the Department-level, DoD has issued multiple policies and guidance that create a structure for the Services to communicate and cooperate with a shared understanding of the Department's intent and vision. These references are listed throughout this document, but include, DoDI 4170.11, as well as the Installation Energy Plan, annual ERCIP guidance, OM&T, and Energy Resilience Guidance documents. In addition to creating a shared language amongst the Services, the Department also encourages cooperation between the Services by instituting Department-wide Working Groups that bring together key stakeholders to disseminate information and elicit input to on-going efforts. With regards to energy resilience and installation energy infrastructure, OSD currently manages the following working groups: Energy Resilience, Cybersecurity, Utilities Privatization, Energy Efficiency, and Distributed Energy.

Lastly, DoD is a substantial stakeholder in DOE's Federal Energy Management Program (FEMP) annual federal government-wide educational activities such as the Federal Utility Partnerships Working Group (FUPWG) and Energy Exchange. These activities allow the Services to share best practices both within the Department and across the federal space (or, in the case of FUPWG, industry).

SECTION 315 (E) *An assessment of the extent to which activities administered under the Federal Energy Management Program (FEMP) could be used to assist with the implementation strategy.*

The Department has an energy focus that differs in many respects than other federal agencies due to the zero-sum nature of linking mission success to energy resilience measurements. To a greater extent than many other agencies, there is little room for error in the execution of DoD missions and, as such, DoD's view of and operations regarding energy occur within a more binary context that is not relevant to other departments (as well as the energy industry as a whole).

The primary benefit to DoD achieved through cooperation with FEMP rests primarily in FEMP's capabilities to provide training on issues related to energy across the entire energy infrastructure domain for the OSD and Service-level staff. This training occurs at annual conferences hosted by

FEMP (FUPWG and Energy Exchange), as well as via FEMP's hosted online training courses for ESPCs and UESCs. DoD will continue to leverage these training opportunities and resources hosted by FEMP as the Department works to support mission assurance within in its energy enterprise.

SECTION 315 (F) *An assessment of state and local partnership opportunities that could achieve efficiency and cost savings, and any legislative authorities required to carry out such partnerships or agreements.*

At present DoD communicates and coordinates with States and local governments, as well as utilities stakeholders, via two distinct channels. At the strategic level, the Department aligns its communications and cooperation through the Mission Assurance (MA) community. DoD's coordinated communications route through DOE, who serves as the primary, although not the only, conduit for communicating with other government organizations at the federal, state, and local levels. Often DHS is also involved in DoD's communications and partnerships via its Critical Infrastructure Partnership Advisory Council (CIPAC) and the coordinating councils/sub-sector councils nestled below it. These are the Energy Governing Coordinating Council and its Subsector Councils, the Electric Sub-Sector Coordinating Council (ESCC) and the Oil and Natural Gas Subsector Coordinating Council (ONGSCC). It is at the Subsector Coordinating Councils that DoD communicates and coordinates with both state and industry executive level stakeholders.

At the regional and installation levels, coordination occurs in a much more dispersed fashion with installations and regional DoD stakeholders serving as the primary communicators. At these levels, installation and regional command stakeholders coordinate directly with state and local governments, as well as the utilities and similar-level energy industry representatives, concerning issues pertaining to matters at that level.

Appendix F - Senate Report 115-125, to accompany S 1519, the NDAA for FY 2018

Energy Assurance on Military Installations, page 106

> In order to assess the current statutory authorities and their appropriateness and flexibility to support energy resilience on military installations, the Secretary of Defense is directed to report to the defense committees within 180 days of enactment of this Act the following: (1) authorities used in award of energy resilience projects during fiscal years 2015-2017 and (2) challenges experienced during fiscal years 2015-2017 in the execution of energy resilience projects due to limitations in existing statutory authorities.

The Energy Resilience and Conservation Investment Program (ERCIP), previously known as the Energy Conservation Investment Program (ECIP), is the only current authority granted to the Secretary of Defense (OSD) for the specific purpose of awarding energy resilience projects. This authority was originally established by the Department of Defense (DoD) in 1976 at the recommendation of the DoD Energy Task Group. The National Defense Authorization Act (NDAA) of 1990 and 1991 formalized energy conservation construction projects under 10 U.S.C. 2865 Energy savings at military installations, paragraph (e), and the NDAA of 2007 created 10 U.S.C. 2914, energy conservation construction projects. The NDAA of 2017 added language to specifically include energy resiliency and energy security as projects that can be executed under 10 U.S.C. § 2914, Energy resiliency and conservation construction projects, in addition to energy conservation projects. DoD revised the name of the program to align with the new language. ERCIP is funded through the Military Construction (MILCON) appropriations process and is centrally managed by the Office of the Deputy Assistant Secretary of Defense for Sustainment, Energy (ODASD(E)).

ERCIP pays for energy resiliency, energy security, or energy conservation projects that are mutually complimentary, to construct new high-efficiency energy systems, or improve and modernize existing ones. The program is managed to maximize the energy benefit to DoD installations by minimizing energy consumption and improving energy resilience of critical energy systems and infrastructure.

Departmental guidance and a rigorous review process direct funding to projects that save energy, reduce DoD's energy costs, improve energy resilience and contribute to mission assurance. The program has implemented energy and water efficiency projects that have assisted with meeting legislated energy conservation targets while providing a significant return-on-investment of more than $2 for every dollar invested (since 2001). The ERCIP has grown to $165M in FY 2018 and the current emphasis on improving energy resilience, saving energy, reducing DoD's energy costs, and contributing to mission assurance together with the competitive nature of the application process should ensure ERCIP project selection is consistent with DoD’s strategic goals. Outside of the inherent challenges of balancing priorities within the necessary constraints of the federal budget environment, a challenge shared by organizations across the federal

government, DoD has no specific lessons learned to communicate with Congress regarding the ERCIP program.

At present DoD is reviewing the applicable statutes and authorities, recent academic and technical reports, and information from other federal agencies and the energy industry in order to determine the most effective methods for measuring the current status of resilience in the Department's energy infrastructure. This effort includes an aggressive schedule of rigorous on-site assessments at multiple installations that host defense critical infrastructure and forces conducting strategic missions. The outputs from this effort will inform a solid understanding of the best courses of action available to the Department to continue increasing resilience and put DoD in position to provide Congress with more detailed suggestions to add to or improve authorities pertaining to energy resilience.

Energy Savings Performance Contracts Assessment, page 107

> The committee directs the Secretary of Defense to provide an assessment to the congressional defense committees no later than 90 days after the date of enactment of this Act. The assessment shall include but not limited to: (1) recommendations on the use of energy savings performance contracts (ESPCs) for savings achieved through training improvements; (2) identification of potential savings that could be achieved through improvements to training; (3) pros and cons of using those savings as part of a long term ESPC; (4) any new authorities that would be needed if a decision was made to use savings as part of additional ESPC; and (5) any other recommendations deemed appropriate.

As the Department understands this reporting requirement, the requirement's primary assumption is that improvements to training for energy service performance contracts (ESPC) will result in behavior change that contributes to an increase in energy savings. Those savings would then be leveraged and used in additional ESPCs. While it may indeed be possible to generate additional savings from training improvements, the Department does not believe that it can commit to and/or predict good behavior with sufficient enough guarantees to be an effective tool in negotiating future contracts with energy savings companies (ESCOs). DoD believes that the financial risk is too high to implement these training improvements based on assumptions about future savings and therefore will not commit limited resources to an assessment that would draw from efforts focused on energy resilience and mission assurance.

Appendix G - House Report 115-200, to accompany HR 2810, the NDAA for FY 2018

Energy Resilience of Overseas Military Installations, page 92

> The "committee directs the Secretary of Defense to provide a briefing to the House Committee on Armed Services by March 1, 2018, on potential vulnerabilities to energy supply disruptions at overseas locations that host permanent and rotational U.S. Armed Forces and on mitigation efforts aimed at protecting mission resiliency. The briefing must, at a minimum, assess the operational risk of energy supply disruptions, identify mitigation measures to sustain mission-critical operations, and assess the feasibility and cost and schedule impactes including diversified energy solutions for future overseas military construction projects."

As defined in 10 U.S.C §101(e)(6), energy resilience directly supports mission assurance and readiness. Energy resilience at DoD installations, whether home or abroad, results from an iterative evaluation, planning and implementation cycle in which mission owners conduct the risk analysis and specify the requirement(s), infrastructure stakeholders solve for the specified requirements, and the process repeats itself as needed to meet changing mission parameters. In this construct, the solutions are unique to the specific mission and its risks as defined by the mission owners.

Energy resilience is achieved in a variety of ways, including redundant power supplies (generators); integrated or distributed fossil, alternative, or renewable energy technologies; microgrid applications including storage; diversified or alternate fuel supplies; upgrading, replacing, operating, maintaining, or testing current energy generation systems, infrastructure, and equipment; as well as mission alternative such as reconstitution or mission-to-mission redundancy. 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 don't.

As part of its energy resilience strategy, DoD pursued changes to policies and guidance related to energy infrastructure. In addition to the updates to Department of Defense Instruction (DoDI) 4170.11, "Installation Energy Management" in FY 2016, the Department updated Department of Defense Directive (DoDD) 4180.01, DoD Energy Policy and published the "Energy Resilience: Operations, Maintenance, & Training (OM&T) Strategy and Implementation Guidance" in FY 2017. The latter guidance outlines a comprehensive strategy to replace or improve emergency power generation readiness, reduce system maintenance, and improve fuel flexibility to ensure the sustainability of all Department emergency power generation systems in operation. Further, DoD has incorporated resilience in its annual update of the primary federal investment program specific to energy infrastructure, the Energy Resilience and Conservation Investment Program (ERCIP).

On May 30, 2018, DoD released a memo to update the March 31, 2016 OASD(EI&E) memorandum "Installation Energy Plans (IEPs)". This update clarifies and provides further direction to installations with regards to energy resilience and cybersecurity. Chief among the

updates are requirements that: (1) by the end of FY 2019 all installations identified Deputy Assistance Secretary of Defense for Defense Continuity and Mission Assurance as priority installations will complete IEPs; (2) by the end of FY 2020, all installations that constitute 75% of each Component's consumption will complete updated IEPs; and (3) by the end of FY 2021, IEPs will be completed for all installations not included in the previous categories. These IEPs provide Components with the opportunity to present their installation-specific long-range plans for energy resilience.

DoD relies on commercial power to conduct missions from its installations. Commercial power supplies can be threatened by a variety of events ranging from natural hazards to physical attacks on infrastructure and cyber-attacks on networks. DoD recognizes that such events could result in power outages affecting critical DoD missions involving power projection, defense of the homeland, and/or operations conducted at installations that are directly supporting warfighting missions overseas. Therefore, installation commanders must understand and address the vulnerabilities and risk of power disruptions that can impact mission assurance[20].

Overseas locations that host permanent and rotational U.S. Armed Forces can face heightened risks associated the supply of energy. These risks are primarily centered on the fact that U.S. Armed Forces generally have even less control than their counterparts in CONUS over the energy supply infrastructure outside the perimeter of their respective locations and, in general, are more proximate to threats and risks. The energy infrastructure outside installations is developed, built and maintained by host nation governments and commercial stakeholders. The agreements regarding how U.S. Armed Forces receive energy supplies and the respective costs are developed in negotiations between the Department of State (DoS) and the respective host nations. DoD, along with other applicable U.S. Government stakeholders, can only advise DoS on existing risks and suggested changes to mitigate these risks in future negotiations.

However, inside the perimeter of U.S. Armed Forces' installation overseas, DoD has greater opportunities to assess and implement solutions for risks to its supply of energy. From a broader mission assurance perspective, in accordance with DoD Directives (DoDDs) 5111.1 and 3020.40, DoD has established and maintains robust mission assurance activities that continuously identify, assess, manage, and monitor the risks to DoD's strategic missions. These activities are managed by the Under Secretary of Defense for Policy (USD(P)) in conjunction with the Chairman of the Joint Chiefs of Staff (CJCS) and they leverage direct input from stakeholders across the Department, ranging from Military Services Secretaries to Combatant Commands to offices throughout OSD. From an installation energy perspective, ODASD(E), the Services, and installation stakeholders leverage the iterative process outlined previously to obtain input from USD(P) and CJCS via the formal Joint Mission Assurance Assessment (JMAA) process and to craft solutions accordingly.

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[20] DoD publishes the status of its energy resilience program at the following: http://www.acq.osd.mil/eie/IE/FEP_Energy_Resilience.html.

The result of this close cooperation between OSD, Service, and installation mission assurance, installation energy, and tenant organizations is a global installation enterprise that is taking all necessary steps to ensure that every installation has available, quality, reliable power in the event of a disruption to the commercial grid or supply of energy. The installation enterprise currently meets mission assurance requirements for redundant power supplies (generators) and DoD is continuing to strengthen its posture through the implementation of additional redundant and diversified power supply projects, as well as heightened attention to OM&T. Table G-1 below outlines a variety of ERCIP projects that were selected and funded in FYs 2017 and 2018 for OCONUS installations to solve for energy supply and demand risks identified by the mission assurance community.

FY	Service	Location	Country	Description	Cost ($000)	SIR	Anticipated Payback (years)
FY 2018	Army	Soto Cano Air Base	Honduras	2.0 MW PV Solar Panels	$12,000	3.2	6.0
FY 2017	Army	American Samoa	American Samoa	Install 325KW PV System	$2,100	1.5	12.6
FY 2018	Air Force	Osan Air Base	Korea	Installation-wide Natural Gas Conversion	$13,700	2.3	7.2
FY 2017	Air Force	Yokota Air Base	Japan	Install EMCS In Multiple Facilities	$1,725	3.2	4.2
FY 2017	Air Force	Kadena Air Base	Japan	Installation-wide Upgrade Exterior Lighting	$4,007	2.6	4.6
FY 2017	Air Force	Misawa Air Base	Japan	Boiler Replacement	$5,315	1.9	8.3
FY 2018	Navy	CFA Yokosuka / Japan	Japan	CFA Yokosuka Smart Grid	$8,530	2.1	9.2
FY 2018	Navy	NSA Naples	Italy	C4i Chiller Replacement	$2,700	2.4	6.6
FY 2018	Navy	NSA Andersen	Guam	885KW Solar BIPV	$5,880	1.5	11.4
FY 2018	Navy	NAVBASE Guam	Guam	Energy Efficient Lights/HVAC/DHW	$2,160	5.8	3.8
FY 2018	Navy	NAVBASE Guam	Guam	R22 HVAC & LED Lighting	$6,920	2.9	9.2
FY 2017	Navy	NSF Diego Garcia	Diego Garcia	3 MW Solar PV Array	$17,010	1	19.1
FY 2017	Navy	NAVBASE Guam	Guam	Solar Assisted HVAC and R-22 HVAC Replacement	$1,240	7.6	2.1
FY 2017	Navy	NAVSTA Guantanamo Bay	Cuba	Electrical Power Plant Controls Upgrade	$6,080	2.4	7
FY 2017	Navy	NAVBASE Guam	Guam	1.6 MW Solar Array & Wasterwater Treatment	$8,540	1.6	10.4
FY 2017	DLA	Rota	Spain	1 MW Solar Array	$3,710	2.2	8.6

Table G-1: OCONUS ERCIP Projects Selected and Funded in FYs 2017 and 2018

Appendix H - House Report 115-219, to accompany HR 3219, Department of Defense Appropriations Bill for FY 2018

Energy Security of Overseas Military Installations, page 60

> The House Armed Services Committee directed the Secretary of Defense to submit a report to the congressional defense committees not later than January 9, 2018 on the potential vulnerabilities of energy supply disruptions at overseas locations hosting permanent and rotational United States armed forces, including medical centers on military installations, and efforts the Department is currently taking to mitigate the risk of potential energy supply disruptions at overseas military installations, including considerations the Department is taking to mitigate such risks when reviewing energy supply options at such installations.

The Department's response for House Report 115-200, to accompany HR 2810, the NDAA for FY 2018 (Appendix G, FY 2017 AEMRR) satisfies this Congressional reporting requirement.

Appendix I - Senate Reports 114-237 & 115-188, Military Construction, Veterans' Affairs, and Related Agencies Appropriations Bills, FYs 2017 & 2018

INTRODUCTION

The Secretary of Defense is directed to report to the Committees on Appropriations of both Houses of Congress and to the Congressional Defense Committees on Water Conservation on Military Installations, in accordance with the Military Construction, Veterans Affairs and related agencies appropriation Bill, 2017 Senate Report 114-237 and the Military Construction, Veterans Affairs and related agencies appropriation Bill, 2018 House of Representatives Report 115-188.

Water Conservation on Military Installations.—The Committee recognizes that the Department of Defense has the opportunity to play a key role in advancing our Nation's water security by implementing water conservation, reuse, and recharge practices on military installations. This should include efforts to incorporate water conservation technologies into new infrastructure design, as well as to update existing infrastructure to make it more water efficient. The Committee also recognizes that many technologies that in-crease water efficiency do not result in competitive returns on in-vestment. Therefore, the Department of Defense is encouraged to implement water conservation projects that are not solely contingent on cost savings performance, but also take into account reduced water use. To assess the current status of water demand and potential water conservation opportunities across U.S. military installations, the Secretary of Defense is directed to report to the congressional defense committees not later than 180 days of enactment of this Act the following: (1) the current water usage on military installations; (2) the vulnerability of each military installation to water scarcity; and, (3) the water conservation potential according to (a) reduced water use and (b) cost savings if current water conservation technologies and efficient design were implemented at military installations.

THE CURRENT WATER USAGE ON MILITARY INSTALLATIONS

The current water usage on military installations is calculated by using water bills, which represent strictly potable water. Potable water includes water purchased from a utility and all fresh water (e.g., well and streams) treated and added to the domestic system for human consumption. During FY 2017, DoD consumed over 81 billion gallons of potable water at a cost of approximately, $262 million.

Figure 1 provides a breakout of total water consumption and costs by Military Service, respectively

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FY 2017 DOD POTABLE WATER		
	Costs ($Thou)	**Consumption (Thou Gal)**
ARMY	$86,923	31,230,400
NAVY	$82,991	21,306,413
USMC	$21,613	6,530,498
AIR FORCE	$70,503	22,175,162
TOTAL	**$262,030**	**81,242,473**

Figure I-1. DoD Water Costs and Consumption

THE VULNERABILITY OF MILITARY INSTALLATION TO WATER SCARCITY

In the context of mission readiness across DoD installations and for purposes of this report, DoD defines scarcity as a condition of drought prone areas. Figure 2 is a map of DoD military installations overlaid on top of drought areas identified by the U.S. Drought Monitor[21] as of April 2018.

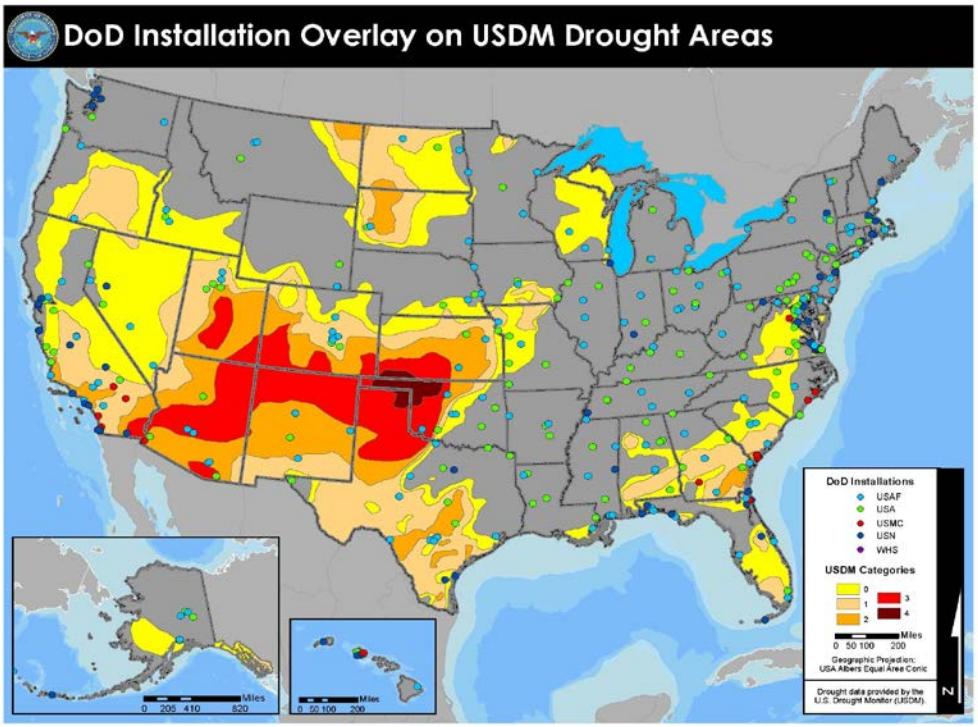

Figure I-2. DoD Military Installation Overlay on Drought Area

[21] The U.S. Drought Monitor website is hosted and maintained by the drought center. U.S. Drought Monitor is jointly produced by the National Drought Mitigation Center at the University of Nebraska-Lincoln, the United States Department of Agriculture, and the National Oceanic and Atmospheric Administration. Map courtesy of NDMC-UNL.

Figure 3 provides a description of the different categories of draught conditions.

	Category	Description	Implication
Gray		None	
Yellow	**0**	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops/pastures. Coming out of drought: some lingering water deficits/pastures or crops not fully recovered
Beige	**1**	Moderate Dry	Some damage to crops, pastures. Streams, reservoirs, or wells low, some water shortages developing or imminent/ Voluntary water-use restrictions requested
Orange	**2**	Severe Drought	Crop or pasture losses likely/Water shortages common. Water restrictions imposed
Red	**3**	Extreme Drought	Major crop/pasture losses. Widespread water shortages or restrictions
Maroon	**4**	Exceptional Drought	Exceptional and widespread crop/pasture losses. Shortages of water in reservoirs, streams, and wells creating water emergencies

Figure I-3. Drought Range Categories

There are 21 DoD Installations that fall into either the "Severe" and "Extreme" categories, Figures 3 and 4, respectively.

Category 2 Installations – Severe Drought		
STATE	INSTALLATION	SERVICE
Georgia	Fort Stewart	USA
Kansas	Fort Riley	USA
New Mexico	White Sands	USA
California	NAVBASE Ventura	USN
California	NAVWPNSTA Seal Beach	USN
Arizona	MCAS Yuma AZ	USMC
South Carolina	MCAS Beaufort SC	USMC
Arizona	Davis Monthan AFB	USAF
California	Los Angeles AFB	USAF
California	Vandenberg AFB	USAF
Georgia	Moody AFB	USAF
Kansas	McConnell AFB	USAF
New Mexico	Cannon AFB	USAF
New Mexico	Holloman AFB	USAF
New Mexico	Kirtland AFB	USAF
Texas	Laughlin AFB	USAF

Figure I-4. DoD Installations in Severe Drought Areas

Category 3 Installations –Extreme Drought		
STATE	INSTALLATION	SERVICE
Arizona	Fort Huachuca	USA
California	NAF El Centro CA	USN
Arizona	Luke AFB	USAF
Oklahoma	Altus AFB	USAF
Oklahoma	Vance AFB	USAF

Figure I-5. DoD Installations in Extreme Drought Areas

WATER CONSERVATION POTENTIAL ON DOD INSTALLATIONS

DoD has steadily reduced its potable water consumption at its installations in excess of the Energy Independence and Security Act of 2007 goal (Figure 7). During FY 2017, DoD reduced its potable water intensity by 26.9% from the 2007 baseline against a goal of 20%. DoD has had great success in achieving water efficiencies through routine maintenance and upgrades of water infrastructure, water efficiency projects, water utilities privatization (UP), and third-party financed projects such as Energy Savings Performance Contracts (ESPCs) and Utility Energy Services Contracts (UESC), which have included water savings investments.

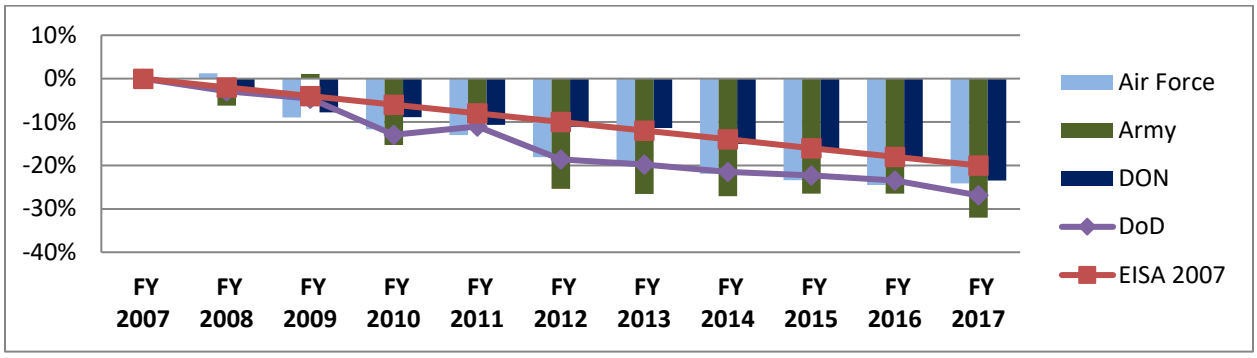

Figure I-6. DoD Potable Water Intensity Reductions against the 2007 Intensity Baseline

DoD has strived for better water management across installations through several policies. First, the Unified Facilities Criteria (UFC) 1-200-02 *High Performance and Sustainable Buildings* requires compliance with industry standard water efficiency practices in new construction and major renovation, where cost-effective. Second, DoD issued an Industrial, Landscaping and Agriculture (ILA) Water Use policy in 2015, and a separate Landscape Architecture water use policy in 2016, to guide the minimal use of water in these applications. Third, DoD is in the process of updating DoD Instruction (DODI) 4170.11 *Installation Energy Management*, the overarching policy guidance document for the Department on installation energy, to explicitly require water management and resilience planning and practices.

The Department will continue to undertake the following approaches to achieve water efficiencies:

- Install water meters at main distribution lines, central heat and chiller plants, and other large uses such as barracks, pools, hospitals, and gyms.
- Increase focus on leak detection and repair

- Support water efficiency projects in existing buildings, such as chiller system improvements, high efficiency cooling towers, low-flow fixtures, and plumbing retrofits.
- Increase use of rainwater harvesting systems, drought-tolerant landscaping and water-efficient irrigation.

Funding for these activities will come from four fund sources: Sustainment, Restoration, and Modernization (SRM) funds, the Energy Resilience and Conservation Investment Program (ERCIP), Energy Savings Performance Contracts (ESPC), and/or Utility Energy Service Contracts (UESC).

While there may be water conservation potential on all DoD installations, there is not always an acceptable business case to invest in all water projects. However, regular maintenance is the most advantageous way towards becoming more resilient. Replacing aging infrastructure reduces consumption and cost, and also controls water loss, a key issue across DoD installations.

WAY FORWARD

Though DoD cannot prepare for every risk and situation, the Department is beginning to include the implications of the changing water landscape in resilience and mission framework.

Long-term planning and investment are essential to water infrastructure across DoD installations and have the capacity to mitigate recurring impacts of drought. Estimating the water conservation potential of DoD installations is challenging due to the diversity of building types and purposes, the deficit of building-level water meters, and installations' capacity to perform the comprehensive water audits that would identify potential water savings. Furthermore, water is a relatively inexpensive commodity, and even some of the most promising water projects can be cost-prohibitive, resulting in low return on investment (ROI). Nevertheless, DoD installations will identify and pursue water conservation projects where cost-effective, and continue to save water through routine operations and maintenance practices such as leak detection and infrastructure upgrades.

Appendix J - Energy Intensity by Installation

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
ARMY	63RD REGIONAL SUPPORT COMMAND	MOFFETT FIELD	CA	5910.42	224.99	38066.00
ARMY	81ST REGIONAL SUPPORT COMMAND	FORT JACKSON	SC	5999.37	230.67	38449.70
ARMY	88TH REGIONAL SUPPORT COMMAND	FORT MCCOY	WI	9622.69	609.44	63333.67
ARMY	99TH REGIONAL SUPPORT COMMAND	JOINT BASE MDL	NJ	7337.05	341.43	46535.08
ARMY	9TH MISSION SUPPORT COMMAND	HONOLULU	HI	173.64	6.90	39715.21
ARMY	ABERDEEN PG	ABERDEEN PROV GRND	MD	14694.50	2640.46	179690.46
ARMY	ADELPHI LABORATORY CTR	HYATTSVILLE	MD	1176.10	188.09	159926.57
ARMY	ALABAMA ARNG	MONTGOMERY	AL	3573.34	220.94	61830.74
ARMY	ALASKA ARNG	FORT RICHARDSON	AK	312.57	180.74	578249.96
ARMY	ANNISTON ARMY DEPOT	ANNISTON	AL	9613.05	623.20	64828.14
ARMY	ARIZONA ARNG	PHOENIX	AZ	1608.09	75.19	46756.14
ARMY	ARKANSAS ARNG	CAMP ROBINSON	AR	4423.56	205.38	46428.41
ARMY	BLUE GRASS ARMY DEPOT	RICHMOND	KY	4165.02	116.83	28051.01
ARMY	CALIFORNIA ARNG	SACRAMENTO	CA	5353.65	176.90	33042.87
ARMY	CAMP ZAMA JAPAN	SAGAMIHARA	JPN	10174.82	655.40	64413.95
ARMY	CARLISLE BARRACKS	CARLISLE	PA	1159.32	140.63	121302.79
ARMY	COLORADO ARNG	ENGLEWOOD	CO	612.12	67.58	110406.50
ARMY	CONNECTICUT ARNG	HARTFORD	CT	1677.33	82.94	49449.93
ARMY	CORPUS CHRISTI AD	CORPUS CHRISTI	TX	2762.00	319.31	115607.89

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
ARMY	DC ARNG (MOB)	WASHINGTON, DC	DC	595.94	85.32	143173.33
ARMY	DELAWARE ARNG	WILMINGTON	DE	671.56	24.87	37031.47
ARMY	DEVENS RFTA	DEVENS	MA	1311.19	107.71	82145.35
ARMY	DUGWAY PROVING GROUND	DUGWAY	UT	2260.25	246.96	109261.27
ARMY	FLORIDA ARNG	SAINT AUGUSTINE	FL	2933.92	73.87	25178.25
ARMY	FORT A P HILL	BOWLING GREEN	VA	1521.81	70.24	46153.73
ARMY	FORT BELVOIR	FORT BELVOIR	VA	13155.85	1057.63	80392.22
ARMY	FORT BENNING	FORT BENNING	GA	20811.62	1360.28	65361.75
ARMY	FORT BLISS	EL PASO	TX	22721.03	1254.32	55205.37
ARMY	FORT BRAGG	FORT BRAGG	NC	34171.58	3203.84	93757.34
ARMY	FORT BUCHANAN	CATANO	PR	1902.42	106.95	56216.38
ARMY	FORT CAMPBELL	FORT CAMPBELL	KY	17053.78	1422.66	83421.76
ARMY	FORT CARSON	COLORADO SPGS	CO	14717.12	1292.95	87853.47
ARMY	FORT DETRICK	FORT DETRICK	MD	3564.84	1072.48	300848.35
ARMY	FORT DRUM	FORT DRUM	NY	12114.39	660.71	54539.45
ARMY	FORT GEORGE MEADE	FORT MEADE	MD	10168.87	644.59	63388.58
ARMY	FORT GORDON	AUGUSTA	GA	10240.73	774.71	75650.15
ARMY	FORT GREELY	DELTA JUNCTION	AK	1098.58	269.02	244883.17
ARMY	FORT HAMILTON	NEW YORK CITY	NY	772.08	67.31	87180.93
ARMY	FORT HOOD	KILLEEN	TX	23348.20	1839.65	78791.99
ARMY	FORT HUACHUCA	FORT HUACHUCA	AZ	5702.28	427.00	74882.30
ARMY	FORT HUNTER LIGGETT	FORT HUNTER LIGGETT	CA	1487.87	40.10	26947.93
ARMY	FORT IRWIN	FORT IRWIN	CA	4304.08	515.51	119771.56
ARMY	FORT JACKSON	COLUMBIA	SC	10318.12	799.67	77501.90
ARMY	FORT KNOX	FORT KNOX	KY	11789.46	930.34	78913.19

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
ARMY	FORT LEAVENWORTH	FORT LEAVENWORTH	KS	4774.93	361.46	75700.11
ARMY	FORT LEE	FORT LEE	VA	10110.53	785.72	77712.71
ARMY	FORT LEONARD WOOD	FORT LEONARD WOOD	MO	12318.97	1390.73	112893.34
ARMY	FORT MCCOY	SPARTA	WI	6929.02	341.35	49264.11
ARMY	FORT POLK	FORT POLK	LA	7810.14	688.37	88137.52
ARMY	FORT RILEY	FORT RILEY	KS	11779.83	999.84	84877.21
ARMY	FORT RUCKER	FORT RUCKER	AL	5942.34	488.74	82247.52
ARMY	FORT SILL	FORT SILL	OK	12199.38	1062.86	87124.00
ARMY	FORT STEWART	FORT STEWART	GA	15190.88	1243.77	81875.93
ARMY	FORT WAINWRIGHT	FORT WAINWRIGHT	AK	6791.11	1869.99	275357.87
ARMY	GEORGIA ARNG	ATLANTA	GA	2070.12	109.55	52920.48
ARMY	GUAM ARNG (MOB)	BARRIGADA	GU	254.87	10.33	40510.07
ARMY	HAWAII ARNG	HONOLULU	HI	1240.73	24.28	19566.67
ARMY	HAWTHORNE AAP (GOCO)	HAWTHORNE	NV	9644.24	150.64	15619.79
ARMY	HOLSTON AAP (GOCO)	KINGSPORT	TN	1959.53	2460.97	1255897.20
ARMY	IDAHO ARNG	BOISE	ID	798.93	112.61	140955.19
ARMY	ILLINOIS ARNG	CAMP LINCOLN	IL	2897.63	145.96	50371.22
ARMY	INDIANA ARNG	INDIANOPOLIS	IN	4585.88	324.57	70776.10
ARMY	IOWA AAP (GOCO)	MIDDLETOWN	IA	3943.49	699.72	177437.96
ARMY	IOWA ARNG	JOHNSTON	IA	3167.68	150.50	47510.11
ARMY	JOINT BASE LEWIS MCCHORD	TACOMA	WA	26495.65	2013.57	75996.37
ARMY	JOINT BASE MYER-HENDERSON HALL	FORT MYER	VA	3731.11	362.13	97055.59
ARMY	KANSAS ARNG	TOPEKA	KS	1513.30	103.72	68540.96

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
ARMY	KENTUCKY ARNG	FRANKFORT	KY	1704.55	61.61	36143.90
ARMY	KWAJALEIN ATOLL	MAJURO ATOLL	MHL	3396.14	864.73	254620.89
ARMY	LAKE CITY AAP (GOCO)	INDEPENDENCE	MO	2864.05	951.76	332312.17
ARMY	LETTERKENNY ARMY DEPOT	CHAMBERSBURG	PA	5328.06	382.84	71854.27
ARMY	LIMA JSMC	LIMA	OH	1619.37	436.12	269316.13
ARMY	LOUISIANA ARNG	JOHNSON BARRACKS	LA	3353.87	146.38	43644.46
ARMY	MAINE ARNG	CAMP KEYES	ME	1302.32	47.70	36629.36
ARMY	MARYLAND ARNG	BALTIMORE	MD	1191.29	88.25	74078.79
ARMY	MASSACHUSETTS ARNG	MILFORD	MA	1979.43	164.35	83030.10
ARMY	MCALESTER AAP	MCALESTER	OK	10357.14	447.76	43231.61
ARMY	MICHIGAN ARNG	LANSING	MI	3787.95	316.81	83634.98
ARMY	MILAN AAP (GOCO)	MILAN	TN	3264.63	18.81	5762.36
ARMY	MILITARY OCEAN TML CONCORD	CONCORD	CA	279.34	11.32	40513.21
ARMY	MINNESOTA ARNG	CAMP RIPLEY	MN	4431.98	245.44	55379.82
ARMY	MISSISSIPPI ARNG	JACKSON	MS	5860.57	210.79	35967.68
ARMY	MISSOURI ARNG	JEFFERSON CITY	MO	1875.47	131.87	70313.08
ARMY	MONTANA ARNG	HELENA	MT	1375.28	80.16	58286.46
ARMY	MOT SUNNY POINT	SOUTHPORT	NC	345.53	14.33	41480.72
ARMY	NEBRASKA ARNG	LINCOLN	NE	1688.44	88.31	52302.61
ARMY	NEVADA ARNG	CARSON CITY	NV	568.32	30.74	54083.78
ARMY	NEW HAMPSHIRE ARNG	CONCORD	NH	793.52	29.77	37514.05
ARMY	NEW JERSEY ARNG	LAWRENCEVILLE	NJ	1220.22	171.97	140935.77
ARMY	NEW MEXICO ARNG	SANTA FE	NM	810.03	57.95	71542.90
ARMY	NEW YORK ARNG	LATHAM	NY	2736.07	170.85	62442.12
ARMY	NORTH CAROLINA ARNG	RALEIGH	NC	1475.56	147.66	100067.49

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
ARMY	NORTH DAKOTA ARNG	BISMARK	ND	1829.47	121.85	66601.27
ARMY	OHIO ARNG	COLUMBUS	OH	3432.10	155.97	45444.54
ARMY	OKLAHOMA ARNG	OKLAHOMA CITY	OK	1984.88	111.48	56163.17
ARMY	OREGON ARNG	SALEM	OR	2300.51	114.63	49829.29
ARMY	PARKS CSTC	DUBLIN	CA	1209.45	43.98	36364.34
ARMY	PENNSYLVANIA ARNG	ANNVILLE	PA	5065.98	320.35	63235.76
ARMY	PICATINNY ARSENAL	DOVER	NJ	3318.29	521.31	157101.20
ARMY	PINE BLUFF ARSENAL	WHITE HALL	AR	3433.89	255.56	74421.78
ARMY	PRESIDIO OF MONTEREY	MONTEREY	CA	2732.55	174.74	63948.23
ARMY	PUEBLO CHEMICAL DEPOT	PUEBLO	CO	4240.04	32.22	7598.27
ARMY	PUERTO RICO ARNG (MOB)	SAN JUAN	PR	1741.07	37.18	21352.93
ARMY	RADFORD AAP (GOCO)	RADFORD	VA	2495.47	2874.06	1151708.25
ARMY	RED RIVER DEPOT	TEXARKANA	TX	7067.28	704.44	99676.01
ARMY	REDSTONE ARSENAL	HUNTSVILLE	AL	13116.22	1512.58	115321.09
ARMY	RHODE ISLAND ARNG	CRANSTON	RI	1267.30	59.74	47135.58
ARMY	ROCK ISLAND ARSENAL	ROCK ISLAND	IL	6526.35	425.85	65250.72
ARMY	SCRANTON AAP	SCRANTON	PA	682.98	409.78	599987.41
ARMY	SIERRA ARMY DEPOT	HERLONG SIERRA ORD-D	CA	5350.91	146.08	27300.41
ARMY	SOLDIER SYSTEMS CTR, NATICK	NATICK	MA	1000.82	104.46	104371.68
ARMY	SOUTH CAROLINA ARNG	COLUMBIA	SC	1380.84	104.69	75812.36
ARMY	SOUTH DAKOTA ARNG	RAPID CITY	SD	1255.56	57.51	45802.61
ARMY	TENNESSEE ARNG	NASHVILLE	TN	2445.93	116.36	47570.77
ARMY	TEXAS ARNG	CAMP MABRY	TX	3462.74	144.44	41713.25
ARMY	TOBYHANNA ARMY DEPOT	UNKNOWN	PA	4432.14	507.28	114455.55
ARMY	TOOELE ARMY DEPOT	TOOELE	UT	3875.10	76.72	19798.95
ARMY	USAG ANSBACH	ANSBACH	DEU	7071.01	297.38	42056.65

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
ARMY	USAG BAVARIA	GRAFENWOHR	DEU	23915.66	1548.89	64764.73
ARMY	USAG BENELUX	BRUSSELS	BEL	5405.14	145.74	26963.02
ARMY	USAG DAEGU	TAEGU	KOR	6568.29	417.38	63544.66
ARMY	USAG DETROIT ARSENAL	HARRISON TOWNSHIP	MI	1926.18	249.60	129581.12
ARMY	USAG HAWAII	WAHIAWA	HI	14689.87	815.05	55483.83
ARMY	USAG HUMPHREYS	CAMP HUMPHREYS	KOR	12639.15	950.72	75220.27
ARMY	USAG MIAMI	MIAMI	FL	781.86	88.16	112757.46
ARMY	USAG RED CLOUD	UIJONG BU	KOR	9888.13	977.15	98820.27
ARMY	USAG RHEINLAND-PFALZ	KAISERLAUTERN	DEU	24536.47	1282.20	52256.86
ARMY	USAG STUTTGART	STUTTGART	DEU	8654.94	613.19	70848.12
ARMY	USAG VICENZA	VICENZA	ITA	8230.31	584.16	70976.10
ARMY	USAG WIESBADEN	WIESBADEN	DEU	9942.13	641.93	64566.77
ARMY	USAG YONGSAN	SEOUL	KOR	8309.83	863.00	103853.41
ARMY	UTAH ARNG	DRAPER	UT	1963.97	128.94	65652.74
ARMY	VERMONT ARNG	COLCHESTER	VT	1204.61	56.82	47166.33
ARMY	VIRGIN ISLANDS ARNG (MOB)	CHRISTIANSTED	VI	319.60	12.49	39083.11
ARMY	VIRGINIA ARNG	FORT PICKETT	VA	3893.87	179.33	46054.13
ARMY	WASHINGTON ARNG	CAMP MURRAY	WA	904.83	47.59	52595.29
ARMY	WATERVLIET ARSENAL	WATERVLIET	NY	2203.28	299.25	135822.09
ARMY	WEST POINT MIL RESERVATION	WEST POINT	NY	7956.56	935.70	117601.40
ARMY	WEST VIRGINIA ARNG	CHARLESTON	WV	2081.10	160.67	77202.35
ARMY	WHITE SANDS MISSILE RANGE	WHITE SANDS	NM	4688.09	280.84	59905.26
ARMY	WISCONSIN ARNG	MADISON	WI	2470.30	179.47	72651.80
ARMY	WYOMING ARNG	CHYENNE	WY	838.34	75.89	90522.73
ARMY	YUMA PROVING GROUND	YUMA	AZ	1899.30	140.36	73899.99

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
AIR FORCE	ABRAHAM LINCOLN CAPITAL AIRPORT	SPRINGFIELD	IL	332.00	19.89	59900.60
AIR FORCE	AIR NATIONAL GUARD READINESS CENTER (ANGRC)	ANDREWS AFB	MD	348.00	24.19	69520.11
AIR FORCE	ALPENA COUNTY REGIONAL AIRPORT	ALPENA	MI	563.17	42.25	75023.26
AIR FORCE	ALTUS AIR FORCE BASE	ALTUS	OK	2591.00	290.40	112080.66
AIR FORCE	ANDERSEN AIR FORCE BASE	AGANA	GU	52.00	2.64	50693.28
AIR FORCE	ARNOLD AIR STATION	ARNOLD A F STATION	TN	2798.00	1518.47	542696.93
AIR FORCE	ATLANTIC CITY INTERNATIONAL AIRPORT	EGG HARBOR TOWNSHIP	NJ	495.00	39.42	79626.26
AIR FORCE	AVIANO AIR BASE	ROVEREDO IN PIANO	ITA	4231.00	289.66	68460.88
AIR FORCE	BANGOR INTERNATIONAL AIRPORT (ANG)	UNKNOWN	ME	511.90	48.99	95692.52
AIR FORCE	BARKSDALE AIR FORCE BASE	BARKSDALE AF BASE	LA	5163.27	425.84	82475.45
AIR FORCE	BARNES MUNICIPAL AIRPORT ANG	WESTFIELD	MA	480.00	36.27	75566.67
AIR FORCE	BEALE AIR FORCE BASE	BEALE AFB	CA	3156.14	343.61	108870.19
AIR FORCE	BIRMINGHAM INTERNATIONAL AIRPORT	BIRMINGHAM	AL	364.82	26.62	72952.99
AIR FORCE	BOISE AIR TERMINAL (ANG)	UNKNOWN	ID	566.00	29.25	51669.61
AIR FORCE	BRADLEY INTERNATIONAL AIRPORT (ANG)	UNKNOWN	CT	400.55	33.05	82504.47
AIR FORCE	BUCKLEY AIR FORCE BASE	AURORA	CO	1709.00	161.14	94287.30
AIR FORCE	BUCKLEY AIR FORCE BASE	AURORA	CO	588.00	56.72	96465.99

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
AIR FORCE	BURLINGTON INTERNATIONAL AIRPORT (ANG)	SOUTH BURLINGTON	VT	479.30	22.69	47333.61
AIR FORCE	CAMP BLANDING MILITARY RESERVATION (ANG)	STARKE	FL	123.60	4.10	33147.25
AIR FORCE	CAMP MURRAY ANG STATION	TACOMA	WA	229.84	13.29	57831.28
AIR FORCE	CAMP PENDLETON MILITARY RESERVATION(ANG)	VIRGINIA BEACH	VA	123.88	4.05	32667.66
AIR FORCE	CAMP PERRY ANG STATION	PORT CLINTON	OH	119.39	4.53	37935.45
AIR FORCE	CANNON AIR FORCE BASE	CANNON AFB	NM	3265.29	365.51	111938.60
AIR FORCE	CARSWELL AIR RESERVE STATION	UNKNOWN	TX	360.00	12.94	35955.56
AIR FORCE	CHANNEL ISLANDS ANG STATION	PORT HUENEME	CA	345.10	17.08	49498.70
AIR FORCE	CHARLESTON AIR FORCE BASE	UNKNOWN	SC	8679.05	715.25	82411.31
AIR FORCE	CHARLOTTE/DOUGLAS INT AIRPORT (ANG)	CHARLOTTE	NC	620.00	26.32	42448.39
AIR FORCE	CHEYENNE REGIONAL AIRPORT	CHEYENNE	WY	432.00	40.99	94872.69
AIR FORCE	COLUMBUS AIR FORCE BASE	COLUMBUS	MS	1579.27	132.67	84007.38
AIR FORCE	DANE COUNTY REGIONAL AIRPORT-TRUAX FIELD	MADISON	WI	474.70	33.93	71474.62
AIR FORCE	DAVIS-MONTHAN AIR FORCE BASE	TUCSON	AZ	4787.00	345.93	72263.84
AIR FORCE	DES MOINES INTERNATIONAL AIRPORT ANG	UNKNOWN	IA	417.42	33.07	79224.76
AIR FORCE	DOBBINS AIR RESERVE BASE	MARIETTA	GA	1050.30	90.92	86567.65
AIR FORCE	DOVER AIR FORCE BASE	UNKNOWN	DE	3855.10	415.88	107878.65
AIR FORCE	DULUTH INTERNATIONAL AIRPORT (ANG)	DULUTH	MN	482.95	55.84	115619.55

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
AIR FORCE	DYESS AIR FORCE BASE	ABILENE	TX	3438.89	276.32	80349.98
AIR FORCE	EARECKSON AIR STATION	ADAK STATION	AK	2915.85	675.07	231517.48
AIR FORCE	EDWARDS AIR FORCE BASE	LANCASTER	CA	7250.00	760.02	104830.90
AIR FORCE	EGLIN AIR FORCE BASE	VALPARAISO	FL	10822.00	1167.74	107904.64
AIR FORCE	EIELSON AIR FORCE BASE	UNKNOWN	AK	3924.91	2146.77	546958.74
AIR FORCE	EIELSON AIR FORCE BASE	UNKNOWN	AK	298.51	25.94	86882.38
AIR FORCE	ELLINGTON FIELD	HOUSTON	TX	493.00	42.22	85636.92
AIR FORCE	ELLSWORTH AIR FORCE BASE	ELLSWORTH AFB	SD	4044.00	417.52	103243.82
AIR FORCE	EWVRA SHEPHERD FIELD ANG	MARTINSBURG	WV	652.00	64.47	98886.50
AIR FORCE	FAIRCHILD AIR FORCE BASE	AIRWAY HEIGHTS	WA	4011.40	412.36	102796.31
AIR FORCE	FAIRCHILD AIR FORCE BASE	AIRWAY HEIGHTS	WA	362.11	26.88	74235.37
AIR FORCE	FORBES FIELD ANG	TOPEKA	KS	484.01	35.88	74138.81
AIR FORCE	FORT SMITH MUNICIPAL AIRPORT ANG	FORT SMITH	AR	418.14	21.99	52591.93
AIR FORCE	FORT WAYNE INTERNATIONAL AIRPORT	FORT WAYNE	IN	426.00	36.05	84629.11
AIR FORCE	FRANCIS E WARREN AIR FORCE BASE	CHEYENNE	WY	3315.65	335.29	101123.16
AIR FORCE	FRANCIS S GABRESKI AIRPORT (ANG)	WESTHAMPTON BEACH	NY	360.00	35.23	97869.44
AIR FORCE	FRESNO YOSEMITE INTERNATIONAL	FRESNO	CA	453.84	23.38	51524.43
AIR FORCE	FT INDIANTOWN GAP ANG STATION	ANNVILLE	PA	348.30	19.19	55099.05
AIR FORCE	GENERAL MITCHELL INTERNATIONAL APT (ANG)	MILWAUKEE	WI	382.79	29.45	76934.33

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
AIR FORCE	GENERAL WAYNE A. DOWNING PEORIA INTERNATIONAL AIRPORT (ANG)	PEORIA	IL	447.90	33.59	74987.72
AIR FORCE	GOODFELLOW AIR FORCE BASE	UNKNOWN	TX	2615.10	217.97	83351.72
AIR FORCE	GRAND FORKS AIR FORCE BASE	GRAND FORKS AFB	ND	2728.90	306.04	112147.75
AIR FORCE	GREAT FALLS IAP ANG	GREAT FALLS	MT	428.00	37.00	86457.94
AIR FORCE	GRISSOM AIR RESERVE BASE	UNKNOWN	IN	1049.00	87.49	83404.19
AIR FORCE	GULFPORT-BILOXI REGIONAL AIRPORT (ANG)	GULFPORT	MS	634.07	28.35	44716.17
AIR FORCE	HANSCOM AIR FORCE BASE	BEDFORD	MA	3534.75	463.78	131205.04
AIR FORCE	HARRISBURG IAP	MIDDLETOWN	PA	330.00	23.04	69821.21
AIR FORCE	HECTOR INTERNATIONAL AIRPORT (ANG)	FARGO	ND	492.19	35.49	72096.87
AIR FORCE	HICKAM AIR FORCE BASE	HICKAM AFB	HI	851.82	34.56	40566.18
AIR FORCE	HILL AIR FORCE BASE	UNKNOWN	UT	13491.73	2307.18	171006.65
AIR FORCE	HOLLOMAN AIR FORCE BASE	UNKNOWN	NM	5443.58	500.84	92006.18
AIR FORCE	HOMESTEAD AIR RESERVE BASE	HOMESTEAD	FL	1112.00	59.52	53526.08
AIR FORCE	HULMAN REGIONAL AIRPORT	TERRE HAUTE	IN	393.47	41.52	105527.20
AIR FORCE	HURLBURT FIELD	EGLIN AFB	FL	4855.22	513.90	105844.89
AIR FORCE	INCIRLIK AIR BASE ADANA	UNKNOWN	TUR	4878.68	299.46	61380.90
AIR FORCE	JACKSON INTERNATIONAL AIRPORT	FLOWOOD	MS	547.00	46.46	84943.33
AIR FORCE	JACKSONVILLE IAP ANG	JACKSONVILLE	FL	442.20	25.98	58756.22
AIR FORCE	JEFFERSON BARRACKS ANG STATION	UNKNOWN	MO	219.94	13.53	61504.54
AIR FORCE	JOE FOSS FIELD ANG	UNKNOWN	SD	441.71	39.42	89236.88

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
AIR FORCE	JOINT BASE ANDREWS-NAVAL AIR FACILITY WASHINGTON	ANDREWS AFB	MD	5360.49	551.39	102861.45
AIR FORCE	JOINT BASE ANDREWS-NAVAL AIR FACILITY WASHINGTON	ANDREWS AFB	MD	490.00	61.96	126442.86
AIR FORCE	JOINT BASE ELMENDORF-FT RICHARDSON	ELMENDORF AFB	AK	11748.47	1681.38	143114.93
AIR FORCE	JOINT BASE ELMENDORF-FT RICHARDSON	ELMENDORF AFB	AK	556.00	52.63	94654.68
AIR FORCE	JOINT BASE SAN ANTONIO (JBSA)	SAN ANTONIO	TX	36077.63	3367.64	93344.34
AIR FORCE	KADENA AIR BASE	KADENA AIR BASE OKINAWA	JPN	23864.49	1194.76	50064.51
AIR FORCE	KEESLER AIR FORCE BASE	BILOXI	MS	6445.66	631.29	97939.67
AIR FORCE	KELLY FIELD ANNEX (LACKLAND AFB)	LACKLAND AFB	TX	388.00	32.96	84945.88
AIR FORCE	KEY FIELD AIR NATIONAL GUARD	MERIDIAN	MS	408.81	23.96	58613.60
AIR FORCE	KIRTLAND AIR FORCE BASE	ALBUQUERQUE	NM	6991.00	809.85	115842.23
AIR FORCE	KIRTLAND AIR FORCE BASE	ALBUQUERQUE	NM	314.40	18.34	58326.42
AIR FORCE	KLAMATH FALLS AIRPORT-KINGSLEY FIELD	KLAMATH FALLS	OR	493.00	38.01	77093.31
AIR FORCE	KUNSAN AIR BASE	KUNSAN	KOR	4036.59	340.82	84431.91
AIR FORCE	LAJES FIELD	LAJESFIELD	PRT	1768.27	38.34	21684.53
AIR FORCE	LAMBERT ST LOUIS IAP ANG	ST. LOUIS	MO	293.85	9.68	32956.04
AIR FORCE	LANGLEY AIR FORCE BASE	LANGLEY AFB	VA	12219.00	1232.62	100877.49
AIR FORCE	LAUGHLIN AIR FORCE BASE	UNKNOWN	TX	1927.11	121.93	63271.95
AIR FORCE	LINCOLN MUNICIPAL AIRPORT (ANG)	UNKNOWN	NE	356.04	30.97	86974.60

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
AIR FORCE	LITTLE ROCK AIR FORCE BASE	UNKNOWN	AR	3506.00	482.39	137589.56
AIR FORCE	LITTLE ROCK AIR FORCE BASE	UNKNOWN	AR	315.00	27.21	86365.08
AIR FORCE	LOS ANGELES AIR FORCE BASE	EL SEGUNDO	CA	1109.00	90.58	81673.58
AIR FORCE	LOUISVILLE INTERNATIONAL AIRPORT - STANDIFORD FIELD	LOUISVILLE	KY	416.81	22.91	54970.55
AIR FORCE	LUIS MUNOZ MARIN INTERNATIONAL AIRPORT	CAROLINA	PR	475.00	27.22	57298.95
AIR FORCE	LUKE AIR FORCE BASE	GLENDALE	AZ	4001.76	313.70	78389.20
AIR FORCE	MACDILL AIR FORCE BASE	UNKNOWN	FL	5131.03	536.53	104565.94
AIR FORCE	MALMSTROM AIR FORCE BASE	MALMSTROM AFB	MT	3338.00	672.12	201355.00
AIR FORCE	MANSFIELD LAHM AIRPORT ANG	MANSFIELD	OH	353.00	31.05	87963.17
AIR FORCE	MARCH AIR RESERVE BASE	UNKNOWN	CA	1994.00	115.43	57886.66
AIR FORCE	MARCH AIR RESERVE BASE	UNKNOWN	CA	307.75	18.48	60058.29
AIR FORCE	MARTIN STATE AIRPORT ANG	MIDDLE RIVER	MD	442.00	20.31	45941.18
AIR FORCE	MAXWELL AIR FORCE BASE	MONTGOMERY	AL	6043.67	609.37	100827.44
AIR FORCE	MCCONNELL AIR FORCE BASE	WICHITA	KS	2414.73	272.13	112693.76
AIR FORCE	MCCONNELL AIR FORCE BASE	WICHITA	KS	529.20	73.20	138322.00
AIR FORCE	MCENTIRE JOINT NATIONAL GUARD BASE	UNKNOWN	SC	454.00	30.43	67022.03
AIR FORCE	MCGHEE TYSON AIRPORT	LOUISVILLE	TN	833.86	78.97	94707.74
AIR FORCE	MCGUIRE AIR FORCE BASE	MCGUIRE AFB	NJ	12645.10	1177.33	93105.63
AIR FORCE	MCGUIRE AIR FORCE BASE	MCGUIRE AFB	NJ	435.60	39.40	90454.55
AIR FORCE	MEMPHIS INTERNATIONAL AIRPORT	MEMPHIS	TN	626.00	65.29	104290.73
AIR FORCE	MINNEAPOLIS-ST PAUL IAP-AIR RESERVE STN	MINNEAPOLIS	MN	710.34	63.58	89503.49

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
AIR FORCE	MINNEAPOLIS-ST PAUL IAP-AIR RESERVE STN	MINNEAPOLIS	MN	467.47	35.50	75938.08
AIR FORCE	MINOT AIR FORCE BASE	MINOT AFB	ND	4405.00	615.64	139760.27
AIR FORCE	MISAWA AIR BASE	MISAWA AFB	JPN	7925.74	1214.89	153284.53
AIR FORCE	MOFFETT FLD ANG	MOUNTAIN VIEW	CA	441.20	12.62	28592.48
AIR FORCE	MONTGOMERY REGIONAL AIRPORT (ANG) BASE	MONTGOMERY	AL	504.60	32.95	65291.32
AIR FORCE	MOODY AIR FORCE BASE	MOODY AF BASE	GA	3199.52	210.02	65640.16
AIR FORCE	MORON AIR BASE	MORAN AB	ESP	732.44	30.35	41434.11
AIR FORCE	MOUNTAIN HOME AIR FORCE BASE	UNKNOWN	ID	3354.30	308.38	91935.83
AIR FORCE	NASHVILLE INTERNATIONAL AIRPORT	NASHVILLE	TN	261.94	20.53	78392.60
AIR FORCE	NELLIS AIR FORCE BASE	LAS VEGAS	NV	9825.71	893.30	90914.96
AIR FORCE	NEW CASTLE COUNTY AIRPORT	UNKNOWN	DE	338.60	29.66	87593.03
AIR FORCE	NEW ORLEANS NAS ANG	BELLE CHASSE	LA	507.00	35.68	70380.67
AIR FORCE	NIAGARA FALLS IAP-AIR RESERVE STATION	NIAGARA FALLS	NY	700.00	76.87	109817.14
AIR FORCE	NIAGARA FALLS IAP-AIR RESERVE STATION	NIAGARA FALLS	NY	185.52	12.08	65109.94
AIR FORCE	NORTH HIGHLANDS ANG STATION	NORTH HIGHLANDS	CA	133.00	5.07	38150.38
AIR FORCE	OFFUTT AIR FORCE BASE	OFFUTT A.F.B.	NE	6447.00	720.88	111815.73
AIR FORCE	OSAN AIR BASE	OSAN AFB	KOR	7948.00	606.74	76338.70
AIR FORCE	OTIS AIR NATIONAL GUARD BASE (ANGB)	OTIS ANGB, MASHPEE	MA	755.12	63.87	84578.72
AIR FORCE	PATRICK AIR FORCE BASE	PATRICK AFB	FL	7062.00	754.96	106903.99

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
AIR FORCE	PEASE INTERNATIONAL TRADEPORT	PORTSMOUTH	NH	547.07	45.83	83767.61
AIR FORCE	PETERSON AIR FORCE BASE	COLORADO SPRINGS	CO	6821.64	1692.08	248045.67
AIR FORCE	PITTSBURGH IAP-AIR RESERVE STN	MOON	PA	569.00	45.38	79760.98
AIR FORCE	PITTSBURGH INTERNATIONAL AIRPORT (ANG)	CORAOPOLIS	PA	449.80	54.61	121407.02
AIR FORCE	PORTLAND INTERNATIONAL AIRPORT	PORTLAND	OR	789.80	61.89	78366.68
AIR FORCE	QUONSET STATE AIRPORT ANG	NORTH KINGSTOWN	RI	399.00	34.84	87320.80
AIR FORCE	RAF ALCONBURY	ALCONBURY	GBR	1561.22	149.43	95710.65
AIR FORCE	RAF CROUGHTON	UNKNOWN	GBR	1096.93	63.74	58108.49
AIR FORCE	RAF FAIRFORD	FAIRFORD	UK	1048.00	35.39	33771.95
AIR FORCE	RAF LAKENHEATH	LAKENHEATH	GBR	7248.82	564.92	77932.69
AIR FORCE	RAF MILDENHALL	MILDENHALL	GBR	2986.17	279.87	93722.76
AIR FORCE	RAMSTEIN AIR BASE	RAMSTEIN	DEU	15836.51	1071.98	67690.41
AIR FORCE	RENO TAHOE INTERNATIONAL AIRPORT	RENO	NV	403.28	25.60	63475.30
AIR FORCE	RICKENBACKER INTERNATION AIRPORT (ANG)	UNKNOWN	OH	508.50	41.90	82403.15
AIR FORCE	ROBINS AIR FORCE BASE	ROBINS AF BASE	GA	13248.00	1909.80	144157.68
AIR FORCE	ROBINS AIR FORCE BASE	ROBINS AF BASE	GA	723.60	57.70	79741.57
AIR FORCE	ROSECRANS MEMORIAL AIRPORT	ST. JOSEPH	MO	399.17	22.36	56014.01
AIR FORCE	SALT LAKE CITY INTERNATIONAL AIRPORT ANG	SALT LAKE CITY	UT	501.27	39.69	79187.50

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
AIR FORCE	SAVANNAH/HILTON HEAD INTERNATIONAL AP	GARDEN CITY	GA	901.18	42.10	46711.98
AIR FORCE	SCHENECTADY COUNTY AIRPORT ANG	SCOTIA	NY	422.00	37.87	89727.49
AIR FORCE	SCHRIEVER AIR FORCE BASE	COLORADO SPRINGS	CO	2263.00	441.19	194958.46
AIR FORCE	SCOTT AIR FORCE BASE	BELLEVILLE	IL	4659.97	581.28	124739.00
AIR FORCE	SCOTT AIR FORCE BASE	BELLEVILLE	IL	353.82	28.65	80959.24
AIR FORCE	SELFRIDGE ANG BASE	MOUNT CLEMENS	MI	1627.00	165.14	101501.54
AIR FORCE	SEYMOUR JOHNSON AIR FORCE BASE	SEYMOUR JOHNSON AFB	NC	3206.03	287.00	89517.25
AIR FORCE	SHAW AIR FORCE BASE	SHAW AF BASE	SC	3319.34	284.50	85709.84
AIR FORCE	SHEPPARD AIR FORCE BASE	WICHITA FALLS	TX	7300.66	627.68	85975.69
AIR FORCE	SIOUX GATEWAY AP/COL. BUD DAY FIELD(ANG)	SIOUX CITY	IA	476.61	35.46	74392.06
AIR FORCE	SKY HARBOR INTERNATIONAL AIRPORT	PHOENIX	AZ	276.00	15.79	57199.28
AIR FORCE	SPANGDAHLEM AIR BASE	SPANGDAHLEM AB	DEU	7504.82	353.43	47093.59
AIR FORCE	SPRINGFIELD BECKLEY MUNICIPAL AIRPORT	SPRINGFIELD	OH	503.55	35.93	71352.97
AIR FORCE	STEWART INTERNATIONAL AIRPORT	UNKNOWN	NY	868.00	92.33	106366.36
AIR FORCE	SYRACUSE HANCOCK FIELD ANG	SYRACUSE	NY	499.00	46.89	93973.95
AIR FORCE	TINKER AIR FORCE BASE	OKLAHOMA CITY	OK	18715.00	2387.52	127572.54
AIR FORCE	TOLEDO EXPRESS AIRPORT ANG	SWANTON	OH	379.00	25.56	67427.44
AIR FORCE	TRAVIS AIR FORCE BASE	FAIRFIELD	CA	6503.15	487.82	75012.62

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
AIR FORCE	TUCSON INTERNATIONAL AIRPORT	TUCSON	AZ	647.00	46.88	72451.31
AIR FORCE	TULSA INTERNATIONAL AIRPORT	TULSA	OK	383.78	35.91	93558.57
AIR FORCE	TYNDALL AIR FORCE BASE	UNKNOWN	FL	4148.88	329.08	79318.03
AIR FORCE	USAF ACADEMY	AIR FORCE ACADEMY	CO	7016.64	790.02	112592.62
AIR FORCE	VANCE AIR FORCE BASE	ENID	OK	1467.93	120.29	81947.37
AIR FORCE	VANDENBERG AIR FORCE BASE	LOMPOC	CA	5092.00	486.99	95638.85
AIR FORCE	VOLK FIELD	CAMP DOUGLAS	WI	668.00	44.26	66263.47
AIR FORCE	W K KELLOGG AIRPORT	BATTLE CREEK	MI	406.00	43.02	105955.67
AIR FORCE	WESTOVER AIR RESERVE BASE	UNKNOWN	MA	1651.20	161.65	97898.50
AIR FORCE	WHITEMAN AIR FORCE BASE	KNOB NOSTER	MO	3773.48	509.66	135063.51
AIR FORCE	WILL ROGERS WORLD AIRPORT	OKLAHOMA CITY	OK	360.64	27.07	75057.40
AIR FORCE	WILLOW GROVE AIR RESERVE STATION	HORSHAM	PA	505.12	36.73	72711.87
AIR FORCE	WRIGHT PATTERSON AIR FORCE BASE	WRIGHT-PATTERSON AFB	OH	16482.00	2875.94	174489.93
AIR FORCE	YEAGER AIRPORT ANG	UNKNOWN	WV	436.93	41.10	94056.04
AIR FORCE	YOKOTA AIR BASE	YOKOTA AFB	JPN	9098.72	1184.48	130180.40
AIR FORCE	YOUNGSTOWN-WARREN REGIONAL AIRPORT ARS	VIENNA	OH	741.50	70.42	94962.91
NAVY	CAMP LEMONNIER DJBOUTI		DJI	1751.00	913.94	521952.60
NAVY	CBC GULFPORT MS	GULFPORT	MS	4632.00	130.33	28136.44
NAVY	CFA CHINHAE KOR		KOR	419.00	27.48	65575.18
NAVY	CFA OKINAWA JA		JPN	841.00	52.72	62684.90
NAVY	CFA SASEBO JA		JPN	4482.00	279.73	62410.75
NAVY	CFA YOKOSUKA JA		JPN	13129.00	2777.75	211573.39

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NAVY	FRC EAST CHERRY POINT NC	CHERRY POINT	NC	2036.00	741.25	364073.67
NAVY	JB PEARL HARBOR-HICKAM HI	PEARL HARBOR	HI	19604.00	1057.47	53941.59
NAVY	JBAB WASHINGTON DC	JOINT BASE ANACOSTIA BOLLING	DC	3490.00	412.90	118309.17
NAVY	JEB LITTLE CREEK-FORT STORY VA	VIRGINIA BEACH	VA	5647.00	635.40	112519.04
NAVY	NAF ATSUGI JA		JPN	4204.00	512.43	121890.82
NAVY	NAF EL CENTRO CA	EL CENTRO	CA	1194.00	69.13	57895.31
NAVY	NAF MISAWA JA		JPN	907.00	82.25	90680.26
NAVY	NAS CORPUS CHRISTI TX	CORPUS CHRISTI	TX	2726.00	199.04	73014.31
NAVY	NAS FALLON NV	FALLON	NV	2188.00	204.63	93523.31
NAVY	NAS JACKSONVILLE FL	JACKSONVILLE	FL	8166.00	895.30	109637.77
NAVY	NAS JRB FORT WORTH TX	FORT WORTH	TX	3325.00	239.18	71932.93
NAVY	NAS JRB NEW ORLEANS LA	NEW ORLEANS	LA	2283.00	165.25	72383.27
NAVY	NAS KEY WEST FL	KEY WEST	FL	2939.00	286.82	97590.00
NAVY	NAS KINGSVILLE TX	KINGSVILLE	TX	1126.00	103.76	92147.42
NAVY	NAS LEMOORE CA	LEMOORE	CA	3575.00	261.43	73126.71
NAVY	NAS MERIDIAN MS	MERIDIAN	MS	1602.00	147.16	91860.17
NAVY	NAS OCEANA VA	VIRGINIA BEACH	VA	7749.00	596.11	76927.73
NAVY	NAS PATUXENT RIVER MD	PATUXENT RIVER	MD	8340.00	916.20	109856.59
NAVY	NAS PENSACOLA FL	PENSACOLA	FL	11410.00	928.58	81383.35
NAVY	NAS SIGONELLA IT		ITA	3014.00	209.16	69394.82
NAVY	NAS WHIDBEY ISLAND WA	OAK HARBOR	WA	3706.00	429.72	115952.24
NAVY	NAS WHITING FIELD MILTON FL	MILTON	FL	1227.00	84.35	68747.35
NAVY	NAVBASE CORONADO SAN DIEGO CA	SAN DIEGO	CA	13917.00	1242.50	89279.37

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NAVY	NAVBASE GUAM		GU	10091.00	607.04	60156.18
NAVY	NAVBASE KITSAP BREMERTON WA	BREMERTON	WA	15223.00	2213.24	145387.64
NAVY	NAVBASE POINT LOMA CA	SAN DIEGO	CA	6317.00	403.27	63838.06
NAVY	NAVBASE SAN DIEGO CA	SAN DIEGO	CA	9203.00	980.68	106560.69
NAVY	NAVBASE VENTURA CTY PT MUGU CA	POINT MUGU	CA	9223.00	329.96	35775.67
NAVY	NAVMAG INDIAN ISLAND WA	PORT HADLOCK	WA	376.00	17.14	45582.45
NAVY	NAVSTA EVERETT WA	EVERETT	WA	1839.00	139.52	75868.95
NAVY	NAVSTA GREAT LAKES IL	GREAT LAKES	IL	9528.00	1023.36	107405.12
NAVY	NAVSTA GUANTANAMO BAY CU		CUB	6506.00	1221.62	187768.83
NAVY	NAVSTA MAYPORT FL	JACKSONVILLE	FL	2901.00	210.75	72645.64
NAVY	NAVSTA NEWPORT RI	NEWPORT	RI	6003.00	594.49	99032.82
NAVY	NAVSTA NORFOLK VA	NORFOLK	VA	15232.00	1854.36	121741.01
NAVY	NAVSTA ROTA SP		ESP	4339.00	194.75	44883.15
NAVY	NAWS CHINA LAKE CA	CHINA LAKE	CA	4651.00	529.84	113918.73
NAVY	NSA ANDERSEN GUAM		GU	6977.00	330.38	47352.30
NAVY	NSA ANNAPOLIS MD	ANNAPOLIS	MD	6078.00	639.06	105142.48
NAVY	NSA BAHRAIN		BHR	2775.00	251.09	90483.60
NAVY	NSA BETHESDA MD	BETHESDA	MD	5638.00	1162.56	206201.14
NAVY	NSA CRANE IN	CRANE	IN	4233.00	775.04	183094.26
NAVY	NSA HAMPTON ROADS VA	NORFOLK	VA	6104.00	887.92	145465.27
NAVY	NSA MECHANICSBURG PA	MECHANICSBURG	PA	11375.00	669.30	58839.38
NAVY	NSA MID SOUTH MILLINGTON TN	MILLINGTON	TN	2757.00	209.60	76026.12
NAVY	NSA MONTEREY CA	MONTEREY	CA	1825.00	140.58	77027.40
NAVY	NSA NAPLES IT	NAPLES	ITA	5629.00	383.34	68100.02

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NAVY	NSA ORLANDO FL	ORLANDO	FL	308.00	23.99	77889.61
NAVY	NSA PANAMA CITY FL	PANAMA CITY BEACH	FL	1483.00	120.81	81465.95
NAVY	NSA SARATOGA SPRINGS NY	SARATOGA SPRINGS	NY	40.00	3.18	79475.00
NAVY	NSA SOUDA BAY GR		GRC	508.00	30.42	59885.83
NAVY	NSA SOUTH POTOMAC DAHLGREN VA	DAHLGREN	VA	6297.00	1444.65	229418.61
NAVY	NSA WASHINGTON DC	WASHINGTON NAVY YARD	DC	9776.00	1819.55	186123.87
NAVY	NSF BEAUFORT SC	BEAUFORT	SC	431.00	68.19	158208.82
NAVY	NSF DIEGO GARCIA		IOT	2325.00	942.31	405294.19
NAVY	NSS NORFOLK NAVAL SHIPYARD VA	NORFOLK	VA	7474.00	353.36	47279.10
NAVY	NSY BOS PORTSMOUTH NH	PORTSMOUTH	NH	4455.00	1086.25	243827.38
NAVY	PMRF BARKING SANDS HI	KEKAHA	HI	595.00	67.12	112813.45
NAVY	SINGAPORE AREA COORDINATOR		SGP	632.00	30.72	48599.68
NAVY	SUBASE KINGS BAY GA	KINGS BAY	GA	5334.00	690.03	129364.45
NAVY	SUBASE NEW LONDON CT	GROTON	CT	3225.00	724.98	224799.69
NAVY	WPNSTA EARLE COLTS NECK NJ	COLTS NECK	NJ	1240.00	144.41	116459.68
NAVY	WPNSTA SEAL BEACH CA	SEAL BEACH	CA	2033.00	78.98	38848.01
NAVY	WPNSTA YORKTOWN VA	YORKTOWN	VA	6072.00	186.07	30643.45
MARINE CORPS	CATC CAMP FUJI JA		JPN	644.00	66.15	102720.50
MARINE CORPS	CG MCAGCC TWENTYNINE PALMS CA	TWENTYNINE PALMS	CA	6800.00	1157.35	170198.53

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MARINE CORPS	CG MCB CAMP BUTLER JA		JPN	15974.00	968.04	60600.79
MARINE CORPS	CG MCB CAMP LEJEUNE NC	CAMP LEJEUNE	NC	26971.00	2600.24	96408.70
MARINE CORPS	CG MCB CAMP PENDLETON CA	CAMP PENDLETON	CA	20220.00	890.80	44055.29
MARINE CORPS	CG MCCDC QUANTICO VA	QUANTICO	VA	7695.00	846.45	109999.35
MARINE CORPS	CG MCLB ALBANY GA	ALBANY	GA	6995.00	222.98	31876.77
MARINE CORPS	FIRST MCD GARDEN CITY LI NY	LONG ISLAND	NY	174.00	52.35	300844.83
MARINE CORPS	MARBKS WASHINGTON DC	WASHINGTON	DC	526.00	46.28	87988.59
MARINE CORPS	MARCORCRUITDEP PARRIS ISLAND SC	PARRIS ISLAND	SC	4036.00	447.75	110939.30
MARINE CORPS	MARCORCRUITDEP SAN DIEGO CA	SAN DIEGO	CA	2703.00	216.79	80202.00
MARINE CORPS	MARFORRES NEW ORLEANS LA	NEW ORLEANS	LA	1891.00	119.83	63367.00
MARINE CORPS	MCAS BEAUFORT SC	BEAUFORT	SC	2862.00	153.41	53603.77
MARINE CORPS	MCAS CAMP PENDLETON CA	CAMP PENDLETON	CA	984.00	44.85	45579.27
MARINE CORPS	MCAS CHERRY PT NC	CHERRY POINT	NC	6572.00	711.36	108241.02
MARINE CORPS	MCAS FUTENMA JA		JPN	1947.00	122.80	63072.42

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MARINE CORPS	MCAS IWAKUNI JA		JPN	7275.00	751.70	103326.19
MARINE CORPS	MCAS MIRAMAR CA	SAN DIEGO	CA	6154.00	299.77	48710.76
MARINE CORPS	MCAS YUMA AZ	YUMA	AZ	3132.00	192.36	61417.62
MARINE CORPS	MCB CAMP MUJUK		KOR	292.00	27.87	95431.51
MARINE CORPS	MCB HAWAII KANEOHE BAY HI	KANEOHE BAY	HI	6342.00	286.43	45164.30
MARINE CORPS	MCLB BARSTOW CA	BARSTOW	CA	4648.00	256.49	55182.87
MARINE CORPS	MCMWTC BRIDGEPORT CA	BRIDGEPORT	CA	318.00	37.88	119132.08
MARINE CORPS	MCSF BLOUNT ISLAND FL	JACKSONVILLE	FL	978.00	28.94	29587.93
MARINE CORPS	NAVAL HOSPITAL CAMP LEJEUNE NC	CAMP LEJEUNE	NC	950.00	136.79	143989.47
MARINE CORPS	NAVAL HOSPITAL CAMP PENDLETON CA	CAMP PENDLETON	CA	926.00	124.25	134182.51
MARINE CORPS	NAVAL HOSPITAL OKINAWA JA		JPN	716.00	155.95	217808.66
DCMA	DCMA (1)	BRATENAHL	OH	77.67	9.02	116111.09
DCMA	DCMA (2)	CARSON	CA	85.00	8.77	103176.47
DECA	88TH REGIONAL SUPPORT COMMAND	INDIANAPOLIS	IN	54.02	7.38	136579.04
DECA	99TH REGIONAL SUPPORT COMMAND	CORAOPOLIS	PA	43.09	7.19	166879.42

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DECA	ABERDEEN PROVING GROUND	ABERDEEN	MD	62.24	7.77	124871.47
DECA	ALTUS AIR FORCE BASE	UNKNOWN	OK	57.78	8.15	141062.03
DECA	ARNOLD AIR STATION	ARNOLD A F STATION	TN	23.19	4.25	183150.81
DECA	AVIANO AIR BASE	UNKNOWN	ITA	64.44	7.13	110593.86
DECA	BANGOR INTERNATIONAL AIRPORT (ANG)	UNKNOWN	ME	29.00	5.05	174034.48
DECA	BARKSDALE AIR FORCE BASE	BARKSDALE AF BASE	LA	103.85	11.10	106879.42
DECA	BEALE AIR FORCE BASE	BEALE AFB	CA	88.00	13.41	152375.00
DECA	BEALE AIR FORCE BASE	BEALE AFB	CA	37.27	7.68	206037.03
DECA	BEALE AIR FORCE BASE	BEALE AFB	CA	75.28	6.57	87323.83
DECA	BUCKLEY AIR FORCE BASE	AURORA	CO	77.43	9.15	118181.11
DECA	CAMP CASEY	TONG DU CHON	KOR	17.20	3.20	185951.85
DECA	CAMP HENRY	TAEGU	KOR	37.79	5.05	133636.77
DECA	CAMP HENRY	TAEGU	KOR	16.03	2.06	128229.13
DECA	CAMP HENRY	TAEGU	KOR	8.10	1.11	136492.66
DECA	CAMP HUMPHREYS	UNKNOWN	KOR	19.19	4.24	221023.56
DECA	CAMP RED CLOUD	UIJONG BU	KOR	10.85	0.76	70046.08
DECA	CAMP RED CLOUD	UIJONG BU	KOR	10.40	0.59	56239.18
DECA	CAMP ZAMA	SAGAMIHARA	JPN	186.02	8.03	43150.81
DECA	CAMP ZAMA	SAGAMIHARA	JPN	67.11	5.89	87706.75
DECA	CAMP ZAMA	SAGAMIHARA	JPN	12.90	1.68	130030.24
DECA	CAMP ZAMA	SAGAMIHARA	JPN	1.84	0.58	317218.90
DECA	CANNON AIR FORCE BASE	CANNON AFB	NM	58.28	6.27	107563.23
DECA	CARLISLE BARRACKS	CARLISLE	PA	59.87	6.07	101301.13
DECA	CBC GULFPORT MS	GULFPORT	MS	30.89	8.26	267203.99

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DECA	CHARLESTON AIR FORCE BASE	UNKNOWN	SC	86.35	11.46	132663.93
DECA	CHARLESTON AIR FORCE BASE	UNKNOWN	SC	63.73	10.65	167100.76
DECA	COLUMBUS AIR FORCE BASE	COLUMBUS	MS	48.95	4.42	90314.80
DECA	COMBAT SUPPORT TRAINING CENTER AND CAMP PARKS	DUBLIN	CA	7.80	1.57	201153.85
DECA	COMFLEACT SASEBO JA	SASEBO	JPN	24.00	3.27	136041.67
DECA	COMFLEACT SASEBO JA	SASEBO	JPN	19.77	2.05	103620.92
DECA	COMFLEACT YOKOSUKA JA	YOKOSUKA	JPN	96.26	16.62	172652.38
DECA	COMFLEACT YOKOSUKA JA	YOKOSUKA	JPN	85.96	15.91	185097.72
DECA	CSO NAS MOFFETT FIELD CA	MOFFETT FIELD	CA	51.94	3.34	64252.16
DECA	DAVIS-MONTHAN AIR FORCE BASE	TUCSON	AZ	114.90	14.08	122502.09
DECA	DOVER AIR FORCE BASE	UNKNOWN	DE	78.38	5.65	72062.88
DECA	DUGWAY PROVING GROUND	DUGWAY	UT	18.11	2.58	142241.86
DECA	DYESS AIR FORCE BASE	ABILENE	TX	79.54	6.86	86267.80
DECA	EDWARDS AIR FORCE BASE	LANCASTER	CA	60.39	6.70	110864.56
DECA	EGLIN AIR FORCE BASE	VALPARAISO	FL	106.84	15.35	143621.95
DECA	EGLIN AIR FORCE BASE	VALPARAISO	FL	63.31	12.07	190727.43
DECA	EIELSON AIR FORCE BASE	UNKNOWN	AK	41.89	7.00	167056.58
DECA	ELLSWORTH AIR FORCE BASE	ELLSWORTH AFB	SD	72.48	8.93	123190.91
DECA	FAIRCHILD AIR FORCE BASE	AIRWAY HEIGHTS	WA	84.78	11.95	140953.05
DECA	FLEET ACTIVITIES CHINHAE KS	CHINHAE	KOR	11.30	2.16	191238.94
DECA	FORT BELVOIR	FORT BELVOIR	VA	141.84	19.18	135220.88
DECA	FORT BENNING	COLUMBUS	GA	117.81	14.60	123919.87
DECA	FORT BENNING	COLUMBUS	GA	2.90	0.36	124654.70
DECA	FORT BLISS	EL PASO	TX	122.60	13.21	107756.93
DECA	FORT BRAGG	FORT BRAGG	NC	95.33	16.53	173400.89

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DECA	FORT BRAGG	FORT BRAGG	NC	118.26	15.21	128580.01
DECA	FORT BUCHANAN	GUAYNABO	PR	95.07	12.17	128017.67
DECA	FORT CAMPBELL	FORT CAMPBELL	KY	121.87	14.87	121992.65
DECA	FORT CARSON	COLORADO SPRINGS	CO	121.96	15.47	126840.71
DECA	FORT DETRICK	FREDERICK	MD	39.28	6.41	163089.69
DECA	FORT DETRICK	FREDERICK	MD	57.97	6.37	109917.03
DECA	FORT DRUM	EVANS MILLS	NY	82.80	12.88	155507.25
DECA	FORT GEORGE G MEADE	FORT MEADE	MD	118.00	15.61	132271.19
DECA	FORT GORDON	AUGUSTA	GA	92.22	12.20	132286.61
DECA	FORT GREELY	DELTA JUNCTION	AK	24.68	5.30	214812.41
DECA	FORT HAMILTON	NEW YORK CITY	NY	50.34	9.16	181922.92
DECA	FORT HOOD	KILLEEN	TX	127.78	20.78	162620.52
DECA	FORT HOOD	KILLEEN	TX	105.66	9.28	87829.72
DECA	FORT HUACHUCA	SIERRA VISTA	AZ	77.56	9.65	124442.38
DECA	FORT JACKSON	COLUMBIA	SC	130.00	10.71	82407.69
DECA	FORT KNOX	MIDDLETOWN	KY	121.84	11.79	96764.66
DECA	FORT LEAVENWORTH	FORT LEAVENWORTH	KS	74.26	11.20	150783.07
DECA	FORT LEE	FORT LEE	VA	242.18	27.54	113703.27
DECA	FORT LEE	FORT LEE	VA	80.77	10.58	131031.24
DECA	FORT LEONARD WOOD	FORT LEONARD WOOD	MO	70.99	11.24	158369.26
DECA	FORT MCCOY	SPARTA	WI	15.93	3.76	236295.13
DECA	FORT POLK	FORT POLK	LA	82.43	10.87	131916.39
DECA	FORT RILEY	FORT RILEY	KS	112.68	15.72	139536.74
DECA	FORT RUCKER	FORT RUCKER	AL	83.55	8.71	104246.46

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DECA	FORT SILL	FORT SILL	OK	101.57	13.66	134498.38
DECA	FORT STEWART	HINESVILLE	GA	94.51	11.29	119422.72
DECA	FORT STEWART	HINESVILLE	GA	57.70	7.24	125459.27
DECA	FORT WAINWRIGHT	FORT WAINWRIGHT	AK	104.49	21.74	208090.49
DECA	FRANCIS E WARREN AIR FORCE BASE	CHEYENNE	WY	77.43	6.69	86392.17
DECA	GOODFELLOW AIR FORCE BASE	UNKNOWN	TX	57.15	7.26	127077.72
DECA	GRAND FORKS AIR FORCE BASE	GRAND FORKS AFB	ND	41.25	3.79	91982.45
DECA	HANSCOM AIR FORCE BASE	BEDFORD	MA	73.50	10.45	142221.56
DECA	HILL AIR FORCE BASE	UNKNOWN	UT	86.90	12.48	143656.14
DECA	HOLLOMAN AIR FORCE BASE	UNKNOWN	NM	68.66	3.47	50507.55
DECA	INCIRLIK AIR BASE ADANA	UNKNOWN	TUR	67.20	6.00	89228.85
DECA	INCIRLIK AIR BASE ADANA	UNKNOWN	TUR	14.79	1.50	101494.35
DECA	JBAB ANACOSTIA BOLLING	WASHINGTON, DC	DC	71.82	11.72	163111.58
DECA	JBPHH PEARL HARBOR - HICKAM HAWAII	PEARL HARBOR	HI	115.41	12.62	109368.50
DECA	JBPHH PEARL HARBOR - HICKAM HAWAII	PEARL HARBOR	HI	98.47	9.81	99638.45
DECA	JBSA - FORT SAM HOUSTON	FORT SAM HOUSTON	TX	104.44	15.48	148254.53
DECA	JBSA - LACKLAND	UNKNOWN	TX	116.75	14.25	122074.90
DECA	JBSA - RANDOLPH	UNKNOWN	TX	96.78	15.31	158164.48
DECA	JNTEXPBASE LITTLE CREEK FS VA	NORFOLK	VA	100.12	11.91	118988.40
DECA	JOINT BASE ANDREWS-NAVAL AIR FACILITY WASHINGTON	ANDREWS AFB	MD	113.41	16.12	142147.96

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
DECA	JOINT BASE ELMENDORF-FT RICHARDSON	ELMENDORF AFB	AK	105.00	17.50	166695.24
DECA	JOINT BASE LEWIS-MCCHORD	TACOMA	WA	147.73	15.88	107488.09
DECA	JOINT BASE LEWIS-MCCHORD	TACOMA	WA	105.00	11.95	113771.43
DECA	JOINT BASE MYER-HENDERSON HALL	ARLINGTON	VA	74.14	8.19	110459.16
DECA	KADENA AIR BASE	OKINAWA	JPN	86.93	16.25	186888.15
DECA	KEESLER AIR FORCE BASE	BILOXI	MS	97.88	16.11	164636.89
DECA	KIRTLAND AIR FORCE BASE	ALBUQUERQUE	NM	107.67	10.45	97092.97
DECA	KUNSAN AIR BASE	KUNSAN	KOR	16.17	4.03	249041.67
DECA	LAJES FIELD	UNKNOWN	POR	57.95	4.29	74015.91
DECA	LANGLEY AIR FORCE BASE	LANGLEY AFB	VA	103.19	14.86	144042.25
DECA	LANGLEY AIR FORCE BASE	LANGLEY AFB	VA	102.64	11.28	109897.60
DECA	LAUGHLIN AIR FORCE BASE	UNKNOWN	TX	74.86	4.71	62879.89
DECA	LITTLE ROCK AIR FORCE BASE	UNKNOWN	AR	100.07	8.50	84974.77
DECA	LOS ANGELES AIR FORCE BASE	EL SEGUNDO	CA	74.77	8.74	116893.36
DECA	LUKE AIR FORCE BASE	GLENDALE	AZ	102.08	11.33	111026.21
DECA	MACDILL AIR FORCE BASE	UNKNOWN	FL	170.81	12.87	75372.50
DECA	MALMSTROM AIR FORCE BASE	MALMSTROM AFB	MT	68.20	7.90	115865.10
DECA	MARCH AIR RESERVE BASE	UNKNOWN	CA	116.56	10.52	90209.50
DECA	MARINE CORPS BASE QUANTICO VA	QUANTICO	VA	121.27	14.82	122243.66
DECA	MAXWELL AIR FORCE BASE	MONTGOMERY	AL	87.00	13.05	149988.51
DECA	MAXWELL AIR FORCE BASE	MONTGOMERY	AL	42.10	5.75	136595.80
DECA	MCAGCC TWENTYNINE PALMS CA	TOPAZ	CA	56.75	9.88	174014.94
DECA	MCAGCC TWENTYNINE PALMS CA	TOPAZ	CA	13.35	2.00	149704.19

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
DECA	MCAS CHERRY POINT NC	CHERRY POINT	NC	59.25	6.66	112397.48
DECA	MCAS IWAKUNI JA	IWAKUNI	JPN	53.88	8.46	157045.81
DECA	MCAS MIRAMAR	SAN DIEGO	CA	90.81	11.67	128501.89
DECA	MCAS YUMA AZ	YUMA	AZ	33.77	4.62	136679.99
DECA	MCB CAMP LEJEUNE NC	CAMP LEJEUNE	NC	75.60	8.40	111075.84
DECA	MCB CAMP LEJEUNE NC	CAMP LEJEUNE	NC	46.12	6.27	136039.38
DECA	MCB CAMP PENDLETON CA	CAMP PENDLETON	CA	113.35	13.84	122077.53
DECA	MCB CAMP PENDLETON CA	CAMP PENDLETON	CA	20.23	2.97	146648.87
DECA	MCB CAMP S D BUTLER OKINAWA JA	ZUKERAN	JPN	290.58	11.66	40136.41
DECA	MCB CAMP S D BUTLER OKINAWA JA	ZUKERAN	JPN	58.93	7.84	132966.81
DECA	MCB CAMP S D BUTLER OKINAWA JA	ZUKERAN	JPN	31.25	5.38	172080.52
DECA	MCB CAMP S D BUTLER OKINAWA JA	ZUKERAN	JPN	31.49	5.23	166079.09
DECA	MCB HAWAII KANEOHE	KANEOHE	HI	76.90	12.74	165695.71
DECA	MCCONNELL AIR FORCE BASE	WICHITA	KS	55.88	7.07	126547.85
DECA	MCGUIRE AIR FORCE BASE	MCGUIRE AFB	NJ	103.00	14.01	135980.58
DECA	MCGUIRE AIR FORCE BASE	MCGUIRE AFB	NJ	18.41	1.36	73597.31
DECA	MCLB ALBANY GA	ALBANY	GA	36.67	5.80	158121.52
DECA	MCLB BARSTOW CA	BARSTOW	CA	22.02	3.11	141351.74
DECA	MCRD BEAUFORT PI SC	PARRIS ISLAND	SC	44.22	3.64	82383.54
DECA	MCSPTACT KANSAS CITY MO	BELTON	MO	23.52	2.96	125786.43
DECA	MINOT AIR FORCE BASE	MINOT AFB	ND	56.42	7.89	139806.10
DECA	MISAWA AIR BASE	MISAWA AFB	JPN	82.46	9.52	115472.77
DECA	MOODY AIR FORCE BASE	MOODY AF BASE	GA	64.26	8.87	138013.13

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
DECA	MOUNTAIN HOME AIR FORCE BASE	UNKNOWN	ID	53.53	6.31	117870.15
DECA	NAF ATSUGI JA	ATSUGI	JPN	32.06	4.65	145152.23
DECA	NAF EL CENTRO CA	EL CENTRO	CA	12.92	2.35	182198.14
DECA	NAS CORPUS CHRISTI TX	CORPUS CHRISTI	TX	46.21	7.36	159203.55
DECA	NAS FALLON NV	FALLON	NV	40.40	3.42	84529.70
DECA	NAS JACKSONVILLE FL	JACKSONVILLE	FL	113.53	17.63	155275.84
DECA	NAS JRB FT WORTH TX	FORT WORTH	TX	92.82	16.59	178771.13
DECA	NAS JRB NEW ORLEANS LA	BELLE CHASSE	LA	46.60	6.48	139141.63
DECA	NAS KEY WEST FL	STOCK ISLAND	FL	21.30	2.78	130704.23
DECA	NAS KINGSVILLE TX	KINGSVILLE	TX	14.72	2.23	151766.30
DECA	NAS LEMOORE CA	LEMOORE NAS	CA	44.15	5.78	130976.38
DECA	NAS MERIDIAN MS	MERIDIAN	MS	31.59	5.48	173498.78
DECA	NAS OCEANA VA	VIRGINIA BEACH	VA	109.91	16.10	146479.49
DECA	NAS PENSACOLA FL	PENSACOLA	FL	73.78	11.29	153008.95
DECA	NAS SIGONELLA IT	SIGONELLA SICILY	ITA	68.03	10.30	151347.22
DECA	NAS WHIDBEY ISLAND WA	OAK HARBOR	WA	66.16	10.07	152267.23
DECA	NAS WHITING FLD MILTON FL	MILTON	FL	21.98	3.85	175175.18
DECA	NATIONAL TRAINING CENTER AND FORT IRWIN	FORT IRWIN	CA	56.50	7.97	141115.04
DECA	NAVAL AIR STATION PAX RIVER	PATUXENT RIVER	MD	55.86	7.51	134389.55
DECA	NAVAL BASE KITSAP BREMERTON WA	BREMERTON	WA	61.21	9.26	151322.56
DECA	NAVAL BASE KITSAP BREMERTON WA	BREMERTON	WA	47.52	6.66	140235.69
DECA	NAVAL STATION GREAT LAKES IL	GREAT LAKES	IL	59.90	8.78	146560.93
DECA	NAVAL STATION NEWPORT RI	NEWPORT	RI	45.95	6.76	147044.74

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
DECA	NAVAL SUPPORT ACTIVITY CRANE	CRANE	IN	8.13	1.07	131873.54
DECA	NAVBASE CORONADO	SAN DIEGO	CA	78.27	13.95	178190.88
DECA	NAVBASE CORONADO	SAN DIEGO	CA	46.27	7.29	157613.75
DECA	NAVBASE GUAM	AGANA	GU	187.24	24.20	129267.25
DECA	NAVBASE GUAM	AGANA	GU	56.92	11.39	200077.30
DECA	NAVBASE SAN DIEGO CA	SAN DIEGO	CA	127.62	16.49	129179.37
DECA	NAVBASE VENTURA CTY PT MUGU CA	POINT MUGU	CA	64.73	7.41	114460.06
DECA	NAVSTA EVERETT WA	EVERETT	WA	60.37	7.95	131711.03
DECA	NAVSTA MAYPORT FL	JACKSONVILLE	FL	71.04	9.50	133660.86
DECA	NAVSTA NORFOLK VA	NORFOLK	VA	78.63	10.96	139430.78
DECA	NAVSTA ROTA SP	ROTA	ESP	50.00	7.11	142140.00
DECA	NAVSUBASE NEW LONDON CT	GROTON	CT	56.85	9.65	169753.90
DECA	NAVSUBASE NEW LONDON CT	GROTON	CT	28.16	3.13	111257.10
DECA	NAVSUPPACT ANNAPOLIS	ANNAPOLIS	MD	47.92	6.78	141560.42
DECA	NAVSUPPACT MIDSOUTH MEMPHIS TN	MILLINGTON	TN	61.26	10.56	172439.69
DECA	NAVSUPPACT NAPLES IT	NAPLES	ITA	85.20	13.50	158448.84
DECA	NAVSUPPACT NORFOLK NSY	PORTSMOUTH	VA	61.91	9.13	147493.05
DECA	NAWS CHINA LAKE	CHINA LAKE	CA	24.17	3.17	131098.70
DECA	NELLIS AIR FORCE BASE	LAS VEGAS	NV	129.89	9.13	70253.37
DECA	NSA ANDERSEN	ANDERSEN AB	GU	122.10	10.65	87215.40
DECA	NSA SARATOGA SPRINGS NY	SARATOGA SPGS	NY	21.98	3.29	149765.71
DECA	NSA SOUTH POTOMAC	DAHLGREN	VA	15.40	2.44	158516.79
DECA	NSY PORTSMOUTH	KITTERY	ME	28.25	5.88	207942.52
DECA	OFFUTT AIR FORCE BASE	OFFUTT A.F.B.	NE	119.59	18.80	157172.96

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
DECA	OSAN AIR BASE	OSAN AFB	KOR	48.60	5.26	108182.62
DECA	OSAN AIR BASE	OSAN AFB	KOR	60.36	5.02	83080.70
DECA	PATRICK AIR FORCE BASE	PATRICK AFB	FL	102.63	9.31	90697.38
DECA	PETERSON AIR FORCE BASE	COLORADO SPRINGS	CO	102.33	12.77	124777.67
DECA	PICATINNY ARSENAL	DOVER	NJ	22.00	4.02	182590.91
DECA	PRESIDIO OF MONTEREY	MONTEREY	CA	111.31	12.68	113886.07
DECA	RAF ALCONBURY	UNKNOWN	GBR	77.14	10.98	142386.77
DECA	RAF CROUGHTON	UNKNOWN	GBR	19.50	3.14	160736.26
DECA	RAF LAKENHEATH	LAKENHEATH	GBR	111.79	18.42	164785.23
DECA	RAF MENWITH HILL	UNKNOWN	GBR	34.37	4.79	139204.05
DECA	RAF MILDENHALL	MILDENHALL	GBR	13.80	2.24	162536.23
DECA	RAMSTEIN AIR BASE	RAMSTEIN	DEU	177.61	24.34	137038.75
DECA	RAMSTEIN AIR BASE	RAMSTEIN	DEU	95.05	12.72	133775.92
DECA	RAMSTEIN AIR BASE	RAMSTEIN	DEU	58.56	10.25	175023.05
DECA	RAMSTEIN AIR BASE	RAMSTEIN	DEU	40.51	7.45	183927.91
DECA	RAMSTEIN AIR BASE	RAMSTEIN	DEU	37.29	2.10	56185.80
DECA	REDSTONE ARSENAL	HUNTSVILLE	AL	80.90	11.35	140284.30
DECA	ROBINS AIR FORCE BASE	ROBINS AF BASE	GA	70.23	10.13	144234.19
DECA	ROCK ISLAND ARSENAL	ROCK ISLAND	IL	33.26	2.73	82140.71
DECA	SCHOFIELD BARRACKS	WAHIAWA	HI	91.93	11.13	121076.96
DECA	SCOTT AIR FORCE BASE	BELLEVILLE	IL	113.65	17.65	155289.83
DECA	SELFRIDGE ANG BASE	MOUNT CLEMENS	MI	75.77	7.38	97344.67
DECA	SEYMOUR JOHNSON AIR FORCE BASE	SEYMOUR JOHNSON AFB	NC	65.66	8.93	136001.58
DECA	SHAW AIR FORCE BASE	SHAW AF BASE	SC	60.57	9.21	152038.96
DECA	SHEPPARD AIR FORCE BASE	WICHITA FALLS	TX	80.67	8.55	105950.17

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
DECA	SPANGDAHLEM AIR BASE	UNKNOWN	DEU	54.02	8.83	163491.62
DECA	SUBASE KINGS BAY GA	KINGS BAY	GA	52.56	7.99	151952.20
DECA	TINKER AIR FORCE BASE	OKLAHOMA CITY	OK	87.03	10.92	125478.30
DECA	TOBYHANNA ARMY DEPOT	TOBYHANNA	PA	22.03	2.85	129556.49
DECA	TRAVIS AIR FORCE BASE	FAIRFIELD	CA	96.50	13.72	142145.08
DECA	TYNDALL AIR FORCE BASE	UNKNOWN	FL	76.37	8.25	108006.18
DECA	US ARMY GARRISON ANSBACH	ANSBACH	DEU	57.51	8.19	142367.81
DECA	US ARMY GARRISON BAUMHOLDER	BAUMHOLDER	DEU	31.87	6.04	189537.77
DECA	US ARMY GARRISON BENELUX	BRUSSELS	BEL	46.47	8.55	183976.07
DECA	US ARMY GARRISON GRAFENWOEHR	GRAFENWOHR	DEU	55.22	11.07	200412.89
DECA	US ARMY GARRISON GRAFENWOEHR	GRAFENWOHR	DEU	51.85	6.45	124349.13
DECA	US ARMY GARRISON GRAFENWOEHR	GRAFENWOHR	DEU	13.65	0.99	72768.58
DECA	US ARMY GARRISON HEIDELBERG	HEIDELBERG	DEU	789.30	20.85	26409.44
DECA	US ARMY GARRISON HOHENFELS	HOHENFELS	DEU	38.20	5.36	140261.78
DECA	US ARMY GARRISON LIVORNO	LIVORNO	ITA	26.46	3.97	150022.68
DECA	US ARMY GARRISON SCHINNEN	SCHINNEN	NLD	24.01	5.27	219454.28
DECA	US ARMY GARRISON STUTTGART	STUTTGART	DEU	64.32	6.50	101114.69
DECA	US ARMY GARRISON STUTTGART	STUTTGART	DEU	40.97	2.85	69494.96
DECA	US ARMY GARRISON STUTTGART	STUTTGART	DEU	5.29	2.14	404122.54

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
DECA	US ARMY GARRISON STUTTGART	STUTTGART	DEU	18.18	1.63	89804.22
DECA	US ARMY GARRISON VICENZA	VICENZA	ITA	54.59	8.77	160590.63
DECA	US ARMY GARRISON WIESBADEN	WIESBADEN	DEU	61.88	10.56	170701.36
DECA	USAF ACADEMY	AIR FORCE ACADEMY	CO	66.69	9.06	135895.40
DECA	VANCE AIR FORCE BASE	ENID	OK	34.30	5.23	152464.80
DECA	VANDENBERG AIR FORCE BASE	LOMPOC	CA	83.29	6.18	74141.22
DECA	WEST POINT MILITARY RESERVATION	WEST POINT	NY	73.22	11.61	158492.78
DECA	WHITE SANDS MISSILE RANGE	LAS CRUCES	NM	32.00	4.26	133031.25
DECA	WHITEMAN AIR FORCE BASE	KNOB NOSTER	MO	60.73	7.92	130392.54
DECA	WRIGHT PATTERSON AIR FORCE BASE	WRIGHT-PATTERSON AFB	OH	123.03	14.17	115177.97
DECA	YOKOTA AIR BASE	YOKOTA AFB	JPN	81.44	19.60	240723.00
DECA	YONGSAN GARRISON	SEOUL	KOR	94.48	15.01	158857.34
DECA	YONGSAN GARRISON	SEOUL	KOR	88.64	2.97	33472.10
DECA	YONGSAN GARRISON	SEOUL	KOR	7.05	1.33	187889.96
DECA	YUMA PROVING GROUND	YUMA	AZ	22.73	2.57	113178.50
DFAS	DFAS LIMESTONE	LIMESTONE	ME	141000.00	10.45	74.12
DFAS	DFAS ROME	ROME	NY	332000.00	140.15	422.15
DIA	DLOC WAREHOUSE	LANDOVER	MD	267.00	12.78	47857.68
DIA	JOINT BASE ANACOSTIA BOLLING	WASHINGTON	DC	1325.00	219.72	165827.17
DIA	ROWE BLDG AND ULC 1/RIVANNA STATION	CHARLOTTESVILLE	VA	184.00	32.14	174668.48

Component	Installation Name	City	State / Country	Goal Subject Square Footage (000 SqFt)	Goal Subject BBTU	Goal Subject Intensity
DLA	DEFENSE DISTRIBUTION DEPOT SAN JOAQUIN	TRACY	CA	5279.36	103.40	19586.28
DLA	DEFENSE DISTRIBUTION DEPOT SUSQUEHANNA	NEW CUMBERLAND	PA	7709.00	313.75	40698.53
DLA	DEFENSE SUPPLY CENTER COLUMBUS	COLUMBUS	OH	3841.00	283.29	73752.96
DLA	DEFENSE SUPPLY CENTER RICHMOND	RICHMOND	VA	4579.00	232.67	50812.84
NRO	BUCKLEY AIR FORCE BASE	AURORA	CO	1254980.00	372.57	296.87
NRO	FORT BELVOIR	FT BELVOIR	VA	1453656.00	425.42	292.65
NRO	NRO HEADQUARTERS	CHANTILLY	VA	1520079.00	173.57	114.19
NRO	PATRICK AIR FORCE BASE	PATRICK AFB	FL	759704.00	70.40	92.67
NRO	VANDENBERG AIR FORCE BASE	LOMPOC	CA	434748.00	37.12	85.37
NRO	WHITE SANDS MISSILE RANGE	LAS CRUCES	NM	234964.00	80.49	342.55
NSA	FORT GEORGE G MEADE	FORT MEADE	MD	13967.70	2670.40	191183.00
WHS	MARK CENTER	ALEXANDRIA	VA	1876.11	109.61	58423.48
WHS	WASHINGTON HQS SERVICE	PENTAGON, ARLINGTON	VA	6967.11	1053.12	151156.46

Appendix K - References

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