Office of the Assistant Secretary of Defense

for

Sustainment

Department of Defense

Annual Energy Management and

Resilience Report (AEMRR)

Fiscal Year 2019

June 2020

COST ESTIMATE
The estimated cost of this report for the Department of Defense is approximately $286,000 in Fiscal Years 2019–2020. This includes $222,000 in expenses and $64,000 in DoD labor. Cost estimate generated on April 7, 2020 / RefID: D-F95E837

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1. Introduction

The chief priority of the Department of Defense (DoD) energy policy is to ensure mission readiness of the armed forces by pursuing energy security and energy resilience. In today's technology-dependent environment, energy requirements are inseparable from the Department's mission requirements, whether discussing weapons platforms or the installations and systems that support those capabilities around the globe. As such, 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 installation energy resilience posture at the Department's 500-plus installations worldwide. The 276,561 buildings, covering 2.267 billion square feet on these installations,[1] account for about 33 percent of DoD's total energy use.[2] Aligning installation energy requirements directly to mission and readiness requirements, agnostic of specific technologies or practices, is the Department's key opportunity to improve energy resilience. Increasing efficiencies, lowering costs, and enhancing backup power options all have significant impact on energy resilience when implemented as part of a comprehensive energy strategy focused on maintaining mission-essential functions in the face of system disruption or stress. The Department will ensure energy resilience and reliability for critical missions while treating installation energy as a force multiplier in support of military readiness.

The Annual Energy Management and Resilience Report (AEMRR) details the Department's Fiscal Year (FY) 2019 performance toward achieving greater energy resilience across its installation enterprise. Additionally, this AEMRR will discuss the Department's efforts to achieve the statutory energy management requirements outlined in title 10 of the United States (U.S.) Code (U.S.C.), section 2925(a). Figure 1 summarizes the Department's progress toward its FY 2019 installation energy goals. While the DoD has made progress towards these statutory goals, continued focus and effort is required.

[1] Real Property Assets Database (RPAD) FY 2019 (data as of 30 Sep 2019)

[2] 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.

Table 1: FY 2019 Progress toward Installation Energy Goals

Goals & Objectives	Metric	Component	FY 2019	Goal
Consume More Electric Energy from Renewable Sources 42 U.S.C. § 15852(a)	Total renewable electricity consumption as a percentage of total facility electricity consumption.	**DoD**	**6.0%**	7.5%
		ARMY	**7.5%**	
		NAVY	**2.8%**	
		USMC	**10.6%**	
		USAF	**6.4%**	
Produce or Procure More Energy from Renewable Sources 10 U.S.C. § 2911(g)	Total renewable energy (electric & non-electric) produced or procured as a percentage of total facility electricity consumption.	**DoD**	**15.6%**	25% by 2025
		ARMY	**15.2%**	
		NAVY	**29.8%**	
		USMC	**15.0%**	
		USAF	**7.9%**	

The FY 2019 AEMRR is compiled based upon the following mandates:

- Section 548 of the National Energy Conservation Policy Act (NECPA) of 1978 (42 U.S.C. § 8258) which requires Federal agencies to describe their energy management activities;
- 10 U.S.C. § 2925(a), which requires DoD to submit to Congress an AEMRR describing its installation energy activities;
- 10 U.S.C. § 2911(c), which requires DoD to establish energy performance goals for transportation systems, support systems, utilities, and infrastructure and facilities;
- 10 U.S.C. § 2688 (g)(4), which requires DoD to report progress in meeting energy resilience metrics for all utility conveyance contracts entered into.

This report also responds to the following seven (7) report requests:

- Two (2) report requests from House Report 116-120, pages 86 and 87, accompanying H.R. 2500, the National Defense Authorization Act (NDAA) for Fiscal Year 2020:
  - *Enhancing Installation Energy Resiliency through Renewable Energy* (Appendix F)
  - *Medium Power Mobile Transformer Substations* (Appendix G)
- One (1) report request from Senate Report 116-48, page 139, accompanying S. 1790, the NDAA for FY 2020:
  - *Defense Energy Resilience Tools for Project Development* (Appendix H)
- Two (2) report requests from House Report 116-63, pages 18 and 19, accompanying H.R. 2745, the Military Construction, Veterans Affairs, and Related Agencies Appropriations Bill, 2020:
  - *Investment in Renewable Energy Systems* (Appendix I)
  - *Energy Conservation* (Appendix J)
- One (1) report request from the Conference Report to the NDAA for FY 2020 (P.L. 116-92), page 1191:
  - *Study on Energy Savings Performance Contracts* (Appendix K)
- One (1) report request from Sec. 2864 of the NDAA for FY 2020 (P.L. 116-92):
  - *Black Start Exercises at Military Installations* (Appendix L)

The compliance matrix in Appendix B illustrates all reporting requirements and requests satisfied by this report.

2. Installation Energy Program Management

Office of the Deputy Assistant Secretary of Defense for Energy (ODASD(Energy))

ODASD(Energy) is positioned within the Office of the Assistant Secretary of Defense for Sustainment (OASD(Sustainment)) organizational structure. The Assistant Secretary of Defense for Sustainment (ASD(Sustainment)) prescribes policies and procedures, provides guidance, and monitors and reviews programs related to energy, environment, facilities management, infrastructure, logistics, and materiel readiness in the DoD.[3]

The mission of ODASD(Energy) is to sustain warfighting readiness and lethality by providing all energy-related policy and governance for programs and activities that enable resilient, efficient, and cyber-secure energy for joint forces, weapon systems, and installations. To accomplish this mission, ODASD(Energy) supports initiatives across four primary areas:

- Energy Resilience: Enhancing the military capability, readiness, and resilience of DoD installations and forces through assured access to resilient and cyber-secure fuel and power.
- Energy Risk: Identifying, assessing, and integrating energy-related analyses and risks into Department decision-making associated with requirements, deliberate planning, wargames and exercises, installation master planning, the Energy Resilience and Conservation Investment Program (ERCIP), and investments in forces and installations.
- Energy Performance: Ensuring energy efficiency and lower costs at DoD installations through reliable, efficient use of power and alternative financing mechanisms.
- Cyber Secure Facilities: Reducing the cyber risks to facility related control systems to ensure reliable power for critical missions.[4]

While ODASD(Energy) encompasses both operational energy (OE) and installation energy (IE), the scope of this report addresses installation energy only.

Department of the Army

The Army's energy, water, and sustainability programs fall under the purview of the Assistant Secretary of the Army for Installations, Energy and Environment (ASA(IE&E)). The Deputy Assistant Secretary of the Army for Energy and Sustainability (DASA(E&S)) is the senior energy official for the Army.

On October 2, 2019 the Army re-designated the Assistant Chief of Staff for Installation Management (ACSIM) as the Deputy Chief of Staff (DCS), G-9 (Installations). The G-9 retained Headquarters Department of the Army (HQDA) staff principal responsibilities previously assigned to the ACSIM. Among the roles and functions, the G-9 continued the implementation and management of the energy and water programs. The Army's AEMRR details the Department of

[3] https://www.acq.osd.mil/log/LMR/about_lmr.html
[4] https://www.acq.osd.mil/log/ENR/index.html

the Army's FY 2019 performance toward achieving greater energy resilience across its installations. It describes the Army's energy and water program management results and implementation of Army energy security and resilience policies set in motion against a backdrop of 18 years of counterinsurgency operations.

The Army's installations form the cornerstone of Army readiness. Strategic readiness, the ability to rapidly mobilize and deploy, is the focus for Army installations. Over the last year installation energy and water programs continued toward improving energy security and resilience.

Using guidance provided by the Deputy Chief of Staff, G-9 (DCS, G-9), landholding Army Commands monitor their progress relative to strategic energy security and sustainability goals and take necessary actions to improve performance. The Army periodically reevaluates metrics to foster a culture of continual process improvement. To further the alignment of energy and water performance to mission performance, the Army continues to integrate energy and water security into total Army readiness. Improving access to reliable and secure energy and water resources supports strategic resource management goals.

Army Regulation 420-1, "Army Facilities Management," guides the management of public works, housing, energy, master planning, military construction projects, utilities services, and fire and emergency services. The Army's Energy Security and Sustainability (ES^2) Strategy fosters more adaptable and resilient installations that are prepared for a future of complexity, uncertainty, adversity, and rapid change. The ES^2 Strategy has served as the foundational driver for more detailed policy. When coupled with the "Energy and Water Goal Attainment Responsibility Policy for Installations," Army Directive 2020-03 "Installation Energy and Water Resilience Policy" formalizes the host of legacy energy and water management requirements. These two Army policy documents underscore effective energy and water management resulting in energy and water resilience and ensuring Army mission readiness.

Department of the Navy (DoN)

The Assistant Secretary of the Navy for Energy, Installations and Environment (ASN(EI&E)) serves DoN and the nation by enhancing combat capabilities for the warfighter through greater energy security; the acquisition and disposal of real property; construction and maintenance of installations; protecting the safety and occupational health of the military and civilian personnel; environmental protection, planning and restoration ashore and afloat; and conservation of natural and cultural resources. The Deputy Assistant Secretary of the Navy for Installations, Energy, and Facilities (DASN(IE&F)) is the principal advisor to ASN(EI&E). Within the Secretariat, the Director for Installation Resilience is responsible for military installation readiness through mission assurance and resilience. Installation resilience is being addressed holistically and includes: energy, water, control system cybersecurity, contingency, physical security, data and network, and environmental resilience. The Director for Installation Resilience is responsible for developing energy, water, and control system strategies, and implementing policies and Navy's Energy Security Programs Office (ESPO) (previously Renewable Energy Program Office) to

promote innovation and optimizes the use of congressional authorities to deliver energy and water resilience on and off DoN military installations.

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 and Mission Assurance Programs. OPNAV N46 also ensures compliance with DoN shore energy goals. The Commander, Navy Installations Command (CNIC) is the shore integrator, responsible for current and future shore energy, water, cyber security, and mission requirements across warfighter enterprises. CNIC N4 (Facilities and Environmental Department), N42 (Energy & Base Operations Support (BOS) Division), and the Energy Headquarters Program Director (Energy, HPD) are responsible for leading and managing the Shore Energy Program while also developing installation energy plan (IEP) summaries, integrating business and support lines, analyzing critical data and ensuring the successful execution of all energy requirements across the Shore Enterprise. The Energy HPD specifically coordinates across ten regions and 71 installations to ensure people, projects, funding, and deliverables align with energy policy.

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 and serves as the Navy's technical authority for the cybersecurity of facility-related control systems (FRCS). NAVFAC also leads the DoN's ESPO, responsible for the development and delivery of installation solutions that address mission critical energy security gaps for both the Navy and Marine Corps.

Ten Region Commanders (REGCOM) are responsible for ensuring proper leadership and management of the Navy's Energy Program in coordination with nine Facility Engineering Commands (FECs). Each region has a Regional Energy Program Manager (REPM). The REPM is responsible for the energy management program across the region as well as the training of installation energy personnel.

REPMs are region energy leads and charged with setting and identifying all region energy security and water management requirements. The REPM supports Installation Energy Managers (IEM) and Supported Commands with defining installation energy and water management requirements and establishes the region energy security and water management program in support of the REGCOM. Together, they develop the Installation Energy program. The REPM works with the Assistant Regional Engineer (ARE) to provide the FEC Energy Management Office (PW8) and IEMs with the necessary resources to meet installation energy and water management requirements. IEMs and REPMs work together to employ subject matter expertise in the energy engineering domain to ensure a strong energy culture aboard the installations. They develop, manage, and implement energy projects, initiate energy awareness programs, and educate leaders, managers, Sailors, civilians, contractors, and families on smart energy use.

The FEC PW8 is charged with executing identified energy resiliency, reliability, and efficiency projects for the region. The FEC PW8 works in coordination with the REPM, the IEM, and others.

The FEC Utilities Management Office (PW6) provides engineering and technical program management for Navy shore utility systems and utility energy assets and infrastructure. The PW6 provides operation, maintenance, procurement, and billing of utilities commodities. They inspect, assess, develop, and manage projects.

Installation Commanding Officers (ICOs) lead the installation's energy and water programs through the development of IEPs, ensuring plans are updated and revalidated annually. IEMs are responsible for leading, managing, and generating requirements to execute the ICO's Energy Program through the support of the Public Works Officer (PWO) and Public Works Department (PWD), and various installation supported commands.

The Deputy Commandant for Installations and Logistics (DC I&L) is responsible for establishing energy and water management policy for United States Marine Corps (USMC) 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 (COMMCICOM) oversees program planning and execution with direct support provided by the MCICOM Facilities Director (MCICOM G-F). The Public Works Section (MCICOM GF-PW) includes program management for the Installation Energy, Utilities, and FRCS programs for the Marine Corps.

Department of the Air Force

Each component of the Air Force Energy Team plays an important role in striving to meet the Service-wide energy priorities to improve resilience, optimize demand, and assure supply. These priorities support the Air Force vision of "enhance mission assurance through energy assurance," which moves the Air Force toward 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 senior energy official in the Air Force. This individual provides guidance, direction, and oversight for all matters pertaining to the formulation, review, and execution of plans, policies, programs, budgets, and Air Force positions regarding federal and state legislation and regulations related to energy and water use. They oversee and monitor all Air Force energy programs and establish Air Force energy direction, strategy, policy, priorities, and oversees implementation of analytical methods to integrate energy considerations into all Air Force business processes.

Headquarters, United States Air Force Deputy Chief of Staff for Logistics, Engineering, and Force Protection (AF/A4) provides information required to support governance and oversight of energy management activities across Air Force installations. This individual develops procedures and objectives to address and manage Air Force facility energy and water consumption, throughput, and requirements in alignment with policies and strategic direction. The AF/A4 develops policies, guidance, procedures, and practices to enhance Air Force energy assurance with the goal of energy resilience, and ensure a state of energy security to meet mission-essential requirements.

The Air Force Installation and Mission Support Center (AFIMSC) and its primary subordinate unit, the Air Force Civil Engineer Center (AFCEC), develop and execute facility energy programs, plans, and policies in support of Air Force strategic energy priorities and goals that are integrated with Major Command mission requirements. These offices assess energy use and risks to identify investment opportunities and efficiency measures to enhance capability and mission success. They provide guidance on energy project development, utility recommendations and requirements validation, capabilities oversight and resource advocacy, and oversight and guidance on budgeting and execution funding. AFIMSC and AFCEC promote policies, procedures, and practices to enhance Air Force energy security and resilience; develop standardized processes for facility energy programs; and provide assistance to installations to meet energy goals and objectives.
The Air Force Office of Energy Assurance (OEA) develops, implements, and oversees an integrated facility energy portfolio, including privately financed, large-scale, clean energy projects that will provide uninterrupted access to the energy necessary for mission success.

Installation personnel develop installation energy and water plans to support or supplement Air Force energy goals and strategies, execute those plans, measure and evaluate their base energy usage and costs, promote total energy awareness, and nominate successful people and units for energy awards. IEMs provide daily management and oversight of the installation's energy plans, energy awareness, education and training, audits, utility billing, and energy and water consumption reporting.

Air Force energy governance provides guidance and oversight of given developments in technology, shifts in resource availability, and changes in operational requirements. Through its governance structure, integrating energy management across mission areas, and implementing cross-functional strategies and policies, the Air Force can improve its operational capabilities and maximize its fiscal resources. The Air Force energy governance structure is in transition, but will comply with revised draft Air Force Policy Directive 90-17, "Energy Management."

Defense Agencies

The Defense Agencies continue to enhance their installation energy management programs and each has a designated senior energy official to administer their respective program (Table 1).

Table 2: Defense Agencies Senior Energy Officials

DoD Component	Senior Energy Official
Defense Contract Management Agency (DCMA)	Energy Program Manager
Defense Commissary Agency (DeCA)	Energy Program Manager
Defense Finance and Accounting Service (DFAS)	Director, Enterprise Management Service
Defense Intelligence Agency (DIA)	Chief, Engineering and Logistics Officer
Defense Logistics Agency (DLA)	Installation Management Director
Missile 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 Energy 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. Energy Resilience

Title 10, U.S.C., section 101(e)(6), defines "energy resilience" as "the ability to avoid, prepare for, minimize, adapt to, and recover from anticipated and unanticipated energy disruptions in order to ensure energy availability and reliability sufficient to provide for mission assurance and readiness, including mission essential operations related to readiness, and to execute or rapidly reestablish mission essential requirements." Energy security is defined by 10 U.S.C. § 101(e)(7) as "having assured access to reliable supplies of energy and the ability to protect and deliver sufficient energy to meet mission essential requirements." The DoD defines availability and reliability in the FY 2017 "Energy Resilience: Operations, Maintenance, & Testing (OM&T) Strategy and Implementation Guidance." Availability is "the availability of an item – under combined aspects of its reliability, maintainability, and maintenance support – to perform its required function at a stated instant of time or over a stated period of time." Reliability is "the ability of a component or system to perform required functions under stated conditions for a stated period of time." Energy resilience includes both availability and reliability as well as two additional critical parameters: (1) resilience includes the capability to adapt to a changing environment in order to maintain or rapidly reestablish mission-essential functions in the face of anticipated and unanticipated disruptions; and, most important, (2) resilience is targeted at ensuring the readiness of military installations.

DoD relies primarily on commercial power to conduct missions from its installations. Commercial power supplies can be threatened by a variety of events ranging from natural hazards and physical attacks on infrastructure to cyber-attacks on its networks and supervisory control and data acquisition (SCADA) systems. The Department recognizes 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 U.S. directly supporting warfighting missions overseas. The Department is working to understand and address the vulnerabilities and risk of power disruptions that can impact mission readiness.[5]

Energy resilience can be enhanced in a variety of ways, including redundant power supplies; identification and isolation of mission-critical power loads and associated circuitry; 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; and mission alternatives such as reconstitution or mission-to-mission redundancy. DoD is agnostic toward specific technologies and practices that are employed to achieve energy resilience; mission capability concerns override preferences toward specific technology implementation goals. An important aspect of energy resilience is to establish an iterative planning and implementation cycle in which

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

mission owners conduct a risk analysis and specify requirements, infrastructure stakeholders solve for the specified requirements, and the process repeats itself as needed to meet changing mission parameters.

Installation Energy Resilience Reporting Requirements

Statutory requirements require DoD to track and report on energy resilience metrics and efforts to work towards minimizing installation energy disruptions and consequently maintain mission readiness. These requirements are reflected in 10 U.S.C. § 2925, 10 U.S.C. § 2911, and 10 U.S.C. § 2688 (Appendix B). For example, under 10 U.S.C. § 2925(a)(4), DoD is required to report the amount, downtime tolerance, and emergency backup generation of each installation's critical energy loads among other data points. The FY 2019 AEMRR data collection cycle was the first to capture critical energy information. The following sections provide more information regarding energy resilience reporting requirements and ongoing efforts of the Department to improve energy resilience.

Utility Outages

Title 10, U.S.C., section 2925(a)(3) requires the annual reporting of unplanned utility outages at military installations. In FY 2019, DoD Components reported 2,572 unplanned utility outages, 542 of which lasted eight hours or longer. Compared to the 408 unplanned utility outages lasting eight hours or longer in FY 2018, this marks an increase of 134 events.

Of the 2,572 reported utility outage events, DoD Components provided financial impacts for 1,221 of the events. The combined length of outages for these events was approximately 2,222 days (median value three hours); the estimated financial impact of these outages was $4,584,973 ($2,063 per outage day).

Utility outages were caused by acts of nature (e.g., weather, storms), equipment failure (e.g., reliability or mechanical issues), or some other event (e.g., vehicle accidents, wildlife interference, operator error, etc.). In FY 2019, 47.6 percent of the reported utility outages were caused by equipment failure, 29.2 percent were caused by acts of nature, and 23.1 percent were considered "other" since they did not fall under these categories. The remaining 0.2 percent of reported utility outages did not specify a cause (Figure 1). The majority of utility outages occurred due to issues on-base (84.9 percent) as opposed to issues off-base related to the local utility service provider (15.0 percent) (Figure 2). As in previous years' reporting, FY 2019 mitigation efforts associated with DoD utility outages included upgrading infrastructure, increasing servicing efforts with local utilities, and pursuing emergency or redundant power supplies such as backup generators.

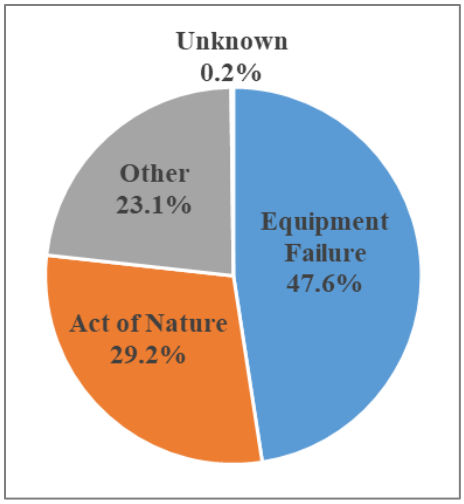

Figure 1: DoD Utility Outage by Cause[6]

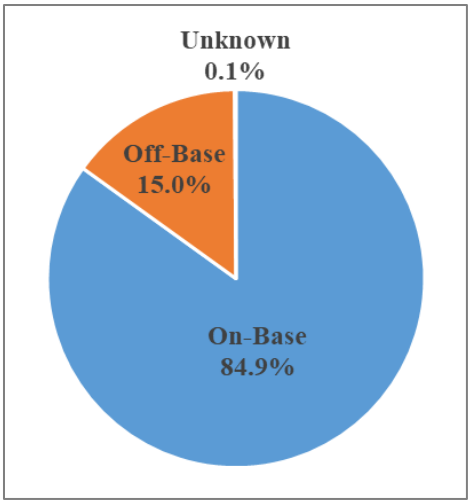

Figure 2: DoD Utility Outage by Cause Location

Electrical disruptions account for the majority of all reported utility outages, followed by water, and then remaining systems in almost equal proportion (Figure 3).

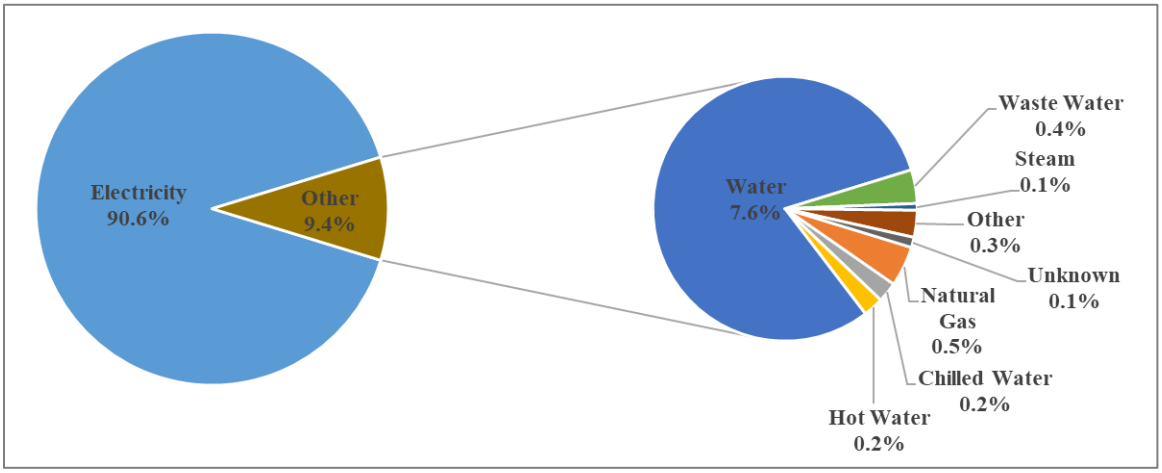

Figure 3: DoD Utility Outage by System

Utility Outages on Privatized Systems

Title 10, U.S.C., section 2688(g)(4) requires DoD to describe its progress in meeting energy resilience metrics for conveyance contracts it has entered into. The Department began collecting outage data to measure progress on privatized systems in FY 2019 for the first time to help comply with this statutory requirement. The following provides details of outage data on privatized systems to help meet this requirement.

[6] "Other" is defined as any unplanned outage cause not attributable to equipment failure or acts of nature, such as vehicle accidents, wildlife interference, or operator error.

In FY 2019, DoD Components reported 493 unplanned utility outages on privatized systems, 66 of which lasted eight hours or longer. Of the 493 reported utility outage events on privatized systems, DoD Components provided financial impacts for 450 of the events. The combined length of outages for these events was approximately 412 days (median value 1.7 hours); the estimated financial impact of these outages was $404,071 ($981 per outage day).

In FY 2019, 39.1 percent of the reported privatized utility outages were caused by equipment failure, 42.4 percent were caused by acts of nature, and 18.3 percent were considered "other" since they did not fall under these categories. The remaining 0.2 percent of reported utility outages did not specify a cause (Figure 4). The majority of utility outages occurred due to issues on-base (92.3 percent) as opposed to issues off-base (7.7 percent) (Figure 5).

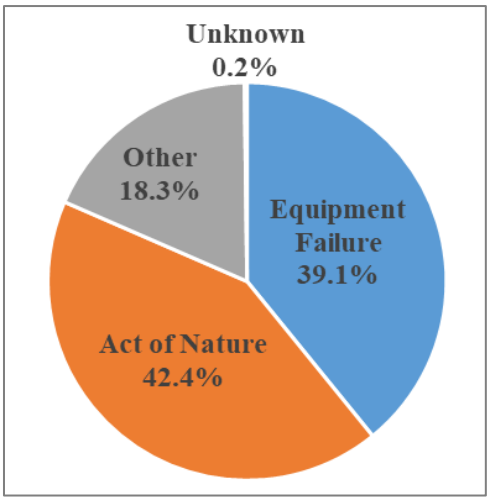

Figure 4: Privatized Utility Outage by Cause

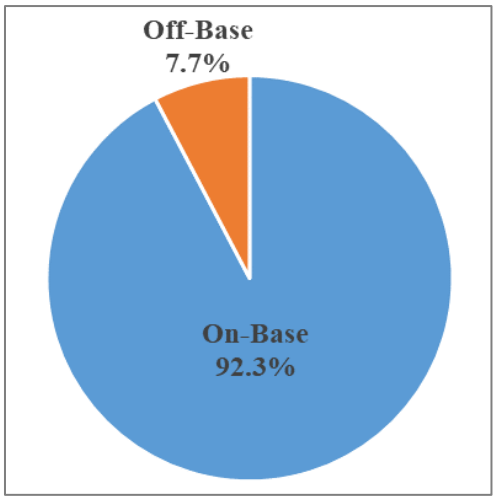

Figure 5: Privatized Utility Outage by Location

Electrical disruptions account for the majority of all reported utility outages, followed by water, and then remaining systems in almost equal proportion (Figure 6).

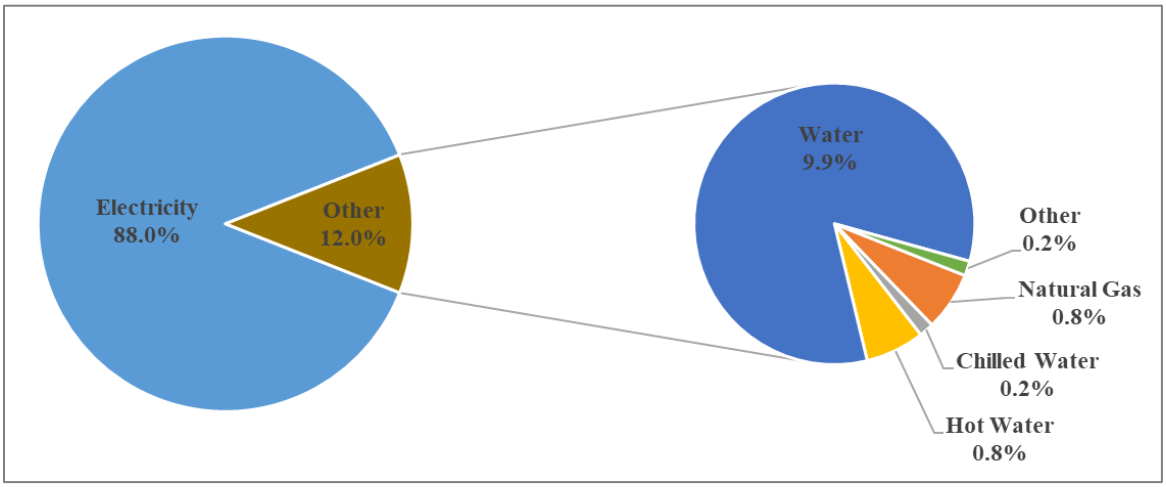

Figure 6: Privatized Utility Outage by System

Critical Energy

Title 10, U.S.C., section 2925(a)(4) requires the annual reporting of critical energy requirements on military installations. Table 3 below provides details to report toward this requirement.

Table 3: Critical Energy Requirements by DoD Component

DoD Component	Peak Critical Electric Power Requirement (MW)	Emergency Backup Capacity of Systems (MW)	Average Age of Emergency Backup Systems (years)	Downtime Tolerances (average annual hours)	Availability (%)
Component 1	967.6	1,017.9	14.1	23.2	99.7%
Component 2	672.4	691.3	16.2	43.7	99.5%
Component 3	155.7	246.2	9.8	53.4	99.4%
Component 4	916.4	1,096.9	13.3	50.3	99.4%
Other	316.1	528.8	12.2	21.7	99.8%

Title 10, U.S.C., section 2925(a)(4) also requires reporting OM&T costs for energy resilience systems. This information is available in Appendix M. ODASD(Energy) will continue to collaborate with DoD Components and review critical energy data collection methodologies. Lessons learned will be incorporated into the reporting guidance and data collection templates of subsequent AEMRRs. For the first time, the Department collected critical energy requirements to better determine mission-based metrics. The availability metric in this figure is what installations reported as their raw availability to meet mission requirements over the course of a year. The reported information in the above table could help the Department establish metrics for its installations in compliance with 10 U.S.C. § 2911(c)(3), such as the necessary levels of availability to ensure mission requirements are met. The outage reporting under 10 U.S.C. § 2925(a)(3) can then be applied to measure performance against mission availability metrics.

Energy Resilience Projects

Title 10, U.S.C., section 2925(a)(5) requires the reporting of a list of energy resilience projects awarded in the reporting fiscal year. Appendix N contains energy resilience projects awarded in FY 2019. Awarded project information was collected during the FY 2019 AEMRR data call.

Title 10, U.S.C., section 2925(a)(6) requires the reporting of a list of planned energy resilience projects for the next two fiscal years. Appendix O contains planned energy resilience projects. Planned project information was submitted by DoD Components during the Planning, Programming, Budgeting, and Execution (PPBE) process.

Office of the Secretary of Defense (OSD) Installation Energy Resilience

As part of its energy resilience focus, DoD continues to adapt policies and guidance related to energy infrastructure. In FY 2016, DoD updated DoD Directive (DoDD) 4180.01, "DoD Energy Policy," and DoD Instruction (DoDI) 4170.11, "Installation Energy Management" to reflect the Department's focus on energy resilience. DoDI 4170.11 specifically requires DoD Components to identify their critical energy requirements and ensure both primary and emergency energy generation systems are available to serve these critical loads. These fundamental elements of energy resilience were captured for most installations across the Department in FY 2019. ODASD(Energy) will continue to improve the collection of this data through issuing updated guidance and helping DoD Components execute against this guidance. In FY 2017, the DoD published the "Energy Resilience: Operations, Maintenance, and Testing (OM&T) Strategy and Implementation Guidance" that outlines an OM&T energy resilience strategy, including development of an 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. These updates served as a foundation for continuing to refine policies and guidance in FY 2019 and prompted ODASD(Energy) to pursue efforts focused on energy resilience.

New Installation Energy Policy and Guidance

Energy Resilience Metrics and Standards Memorandum

Title 10, U.S.C., section 2911(b)(1) requires the Secretary of Defense to "establish metrics and standards for the assessment of energy resilience." In February 2020, the Under Secretary of Defense for Acquisition and Sustainment (USD(A&S)) issued the "Metrics and Standards for Energy Resilience at Military Installations" memorandum to satisfy this requirement. Through this memorandum, the Department establishes metrics and standards for energy resilience at permanent and enduring installations to help mitigate risks to DoD critical infrastructure and ensure secure access to energy resources for critical missions. The Department will continue to measure installation energy resilience using these metrics and standards and collect this information during the AEMRR data collection process.

Black Start Exercise Framework

ODASD(Energy), in collaboration with the Massachusetts Institute of Technology Lincoln Laboratory (MIT-LL), issued "A Framework for Planning and Executing Energy Resilience Readiness Exercises" in January 2020. This document codifies best practices and lessons learned from black start exercises conducted to date and is a resource for DoD Components to leverage for future black start exercise planning and execution. ODASD(Energy) will update this framework periodically as black start exercises are completed and new lessons learned are discovered.

Lines of Effort

Energy Resilience Exercises

Title 10, U.S.C., section 2911(b)(2) requires "the Secretary of a military department to perform mission assurance and readiness assessments of energy power systems for mission critical assets and supporting infrastructure.…" Since 2016, in collaboration with ODASD(Energy), MIT-LL has visited 34 DoD installations to understand their current energy resilience posture and to outline recommendations for increased energy resilience. During these site visits, MIT-LL collected a variety of energy resilience information and at some locations, conducted Energy Resilience Table-Top Exercises (ERTTXs) or black start exercises. ERTTXs are simulated, war-room exercises that assess an installation's ability to respond to different power disruption scenarios. Black start exercises are real-world exercises whereby power is disconnected from all or part of an installation to assess the energy resilience posture of the installation. These exercises help installations understand their energy resilience posture and risk of energy disruptions by identifying infrastructure interdependencies that may not be apparent during routine OM&T.

In FY 2019, the Department conducted ERTTXs at Naval Submarine Base (NSB) Kings Bay, Joint Base (JB) Pearl Harbor Hickam, and Vandenberg Air Force Base and black start exercises at Fort Greely, Fort Bragg, and Hanscom Air Force Base. The Department is encouraged by the outcomes of these exercises. While each exercise highlighted installation-specific vulnerabilities or incorrect assumptions, they also enabled constructive engagement between mission owners and tenants on current resilience posture and the development of strategic investments to be outlined in their respective IEPs. In FY 2020, the Department will continue to conduct these exercises.

Additionally, Senate Report 1790 requests the Department to conduct three black start exercises, including one at a joint base, and to provide a report on historical black start exercises at military installations. Appendix L contains the Department's response to this report request.

Energy Resilience Assessment (ERA) Tool

The ERA Tool analyzes the energy resilience baseline for military installations in terms of the life-cycle cost and amount of unserved load associated with the current design of the utility system. It then explores alternative resilient energy technology combinations (referred to as "architectures") capable of meeting the mission required electrical loads. This analysis of alternatives provides a method for comparing different technologies across their life-cycle cost and performance in meeting electrical loads, a common roadblock when evaluating competing project proposals. The tool examines over one hundred potential architectures that include both centralized and distributed energy solutions, diesel and natural gas generation, solar photovoltaics, energy storage, fuel cells, and more.

The ERA Tool also determines reliability metrics and performs system reliability modeling for these different generation sources. The reliability metrics are an input to the Monte Carlo simulation engine that allows the DoD to predict the amount of unserved load (the availability or

resilience metric) for the critical energy loads identified at each military installation. The ERA Tool compares the life-cycle cost predictions and availability (energy resilience metric) of different potential energy resilience solutions at each military installation. This allows mission owners and installation personnel to determine how much they are willing to spend to achieve different levels of energy resilience. The output generated by the ERA Tool is a required element of project submission packages under ERCIP.

The ERA Tool was aligned to DoD requirements to ensure enterprise-wide adoption across the Department. For example, the tool was aligned to life-cycle cost methodologies under part 10, Code of Federal Regulations (CFR) section 433.8, and National Institute of Standards and Technology (NIST) Handbook 135 which are required to meet energy resilience requirements in DoDI 4170.11, "Installation Energy Management." Further, the tool incorporated well-known life-cycle cost analysis methodologies from Comptroller and Cost Assessment and Program Evaluation (CAPE) guides such as Financial Management Regulations (FMRs), DoD 5000.04-M, "DoD Cost Analysis Guidance and Procedures," and DoDI 5000.02, "Operation of the Defense Acquisition System." These proven guides provide a foundation for analysis of alternative, affordability, trade-space, and reliability, availability, and maintainability (RAM) analyses important to meet DoD mission requirements. The ERA Tool has proven that that the DoD does not need to pursue energy resilience solutions through "premium" analyses. Instead, the Department is leveraging well-known and required life-cycle cost analyses methods to pursue affordable energy resilience solutions which meet its mission requirements.

Additionally, Senate Armed Services Committee (SASC) Report 116-48 requests an implementation plan for the ERA Tool to ensure its use across the Department. Appendix H contains the Department's response to this report request.

Energy Resilience Project Funding

The Energy Resilience and Conservation Investment Program (ERCIP)

ERCIP, which is authorized by 10 U.S.C. § 2914, is a critical element of the Department's strategy to improve the energy resilience, energy security, and energy conservation of its fixed installations. As a Military Construction (MILCON) program, ERCIP has traditionally funded projects that promise a significant payback via reduced energy costs. Moving forward, ERCIP will focus on improving energy resilience, security, availability, reliability, and economic performance.

The Energy Conservation and Investment Program (ECIP) was initiated in FY 2007 with a $35 million appropriation for investments in energy and water conservation projects. The FY 2017 NDAA added "Resilience" to ECIP, and changed the program name to ERCIP, expanding investments to include energy resilience, availability, and reliability. Although ERCIP has enjoyed strong support from Congress and the Office of Management and Budget (OMB), it is a relatively small program historically funded at $150M, but has been adjusted to approximately $142.5M annually for the FY 2022 - 2026 Future Years Defense Program (FYDP). In FY 2018,

ERCIP received a $15M congressional add, $43M in FY 2019, and $83M in FY 2020. At this funding level, the program will provide a small yet important contribution to DoD's projected investment needed to meet legislative, executive, and agency energy requirements. Additionally, ERCIP offers installations the opportunity to fund energy resilience projects without competing directly for dollars against other priorities within the broader MILCON appropriations.

The Department prioritizes projects based on the following criteria (listed in order of decreasing importance):

1) Inclusion in an installation, region, department, or DoD Component energy plan;
2) Contribution to energy resilience, energy security, and mission readiness and assurance at an installation;
3) Location on an installation on the DoD's priority installation list;
4) Service priority;
5) Results of the OSD ERA Tool;
6) Savings to Investment Ratio and the Simple Payback;
7) Value of resilience attributes that do not cash flow (e.g., cost avoidance for work stoppage caused by power outage);
8) Leverage of DoD demonstrated technology (e.g., a technology that has been demonstrated in an Environmental Security Technology Certification Program (ESTCP) project;
9) DoD Component's past obligation rate (i.e., the percentage of funds obligated versus the amount appropriated);
10) Impact on energy consumption at an individual installation;
11) Diversification of energy technologies meaning combining different types of energy technologies, such as generation, storage, and control technologies; and
12) Contribution towards Executive Order (EO) 13834 objectives.

Non-Federal Financing of Energy Resilience Projects

There are several authorities that enable the Department to leverage private financing for energy projects. Third-party (or "alternative") financing is available through:

- Energy Savings Performance Contracts (ESPC) (42 U.S.C. § 8287),
- Utility Energy Service Contracts (UESC) (10 U.S.C. § 2913(d)),
- Power Purchase Agreements (PPA) (10 U.S.C. § 2922a),
- Enhanced Use Leases (EUL) (10 U.S.C. § 2667),
- Easements (10 U.S.C. § 2668), and
- Utilities Privatization (UP) (10 U.S.C. § 2688).

The Defense Energy Resilience Bank (DERB)

Despite the Department's extensive experience in leveraging alternative financing authorities, DoD has limited insight into the how the financial industry and commercial lender organizations view risk for energy resilience projects. The Department commissioned the DERB study to

explore policy and programmatic solutions to accelerate alternative financing of energy resilience projects. The report provides recommendations on increasing the availability, access, and volume of third-party financing to fund mission-critical energy resilience projects across military installations. ODASD(Energy) will continue to work with DoD Components to explore the feasibility of implementing these recommendations. The final DERB Report was issued by the Deputy Assistant Secretary of Defense for Energy (DASD(Energy)) in February 2020 and can be found on the OASD(Sustainment) website.[7]

ODASD(Energy) is interested in leveraging its ERA Tool and an increased understanding of the financial industry's risk calculus to develop an energy resilience business case framework that allows stakeholders and decisions makers in government and the private sector to consider wide-scale adoption of alternative financing for energy resilience projects on DoD installations.

Energy Resilience Technology and Infrastructure Solutions

A variety of technical solutions have the potential to promote energy resilience in the form of energy generation and infrastructure hardening for DoD missions on fixed installations. Current technology and equipment solutions include, but are not limited to, small backup generation units, microgrids, large scale solar photovoltaic arrays, energy storage systems, co-generation plants, and distribution system hardening. The following technologies are being pursued by the Department to enhance energy resilience and mission readiness on DoD installations.

- *Backup Generators*
  Diesel generators dominate backup power needs across all installations and provide a reliable power source if and when they are sufficiently maintained and fueled. Uninterruptible power supplies (UPS) are also commonly used to bridge the generator startup time for critical loads that cannot experience brief power outages. However, multiple analyses conducted by both the OSD and the Components have shown that many installations would both increase energy resilience 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 by manufacturer's recommendations and the DoD OM&T guidance.

- *Microgrids*
  Once a fundamental resilience baseline is implemented on an installation, other energy technologies enabled by a microgrid can be considered to further increase resilience (and in some cases, reduce expenses). Microgrids enable 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

[7] https://www.acq.osd.mil/eie/IE/FEP_Energy_Resilience.html

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. Examples of long-established and successful microgrids at DoD installations include Naval Base Guam Telecommunications Site (NBGTS) Finegayan, Guam and the Marine Corps Air and Ground Combat Center (MCAGCC) Twentynine Palms, CA. However, microgrids are not a simple plug-and-play solution; cooperation with local utilities, an understanding of mission-critical functions and their associated load demand, customized engineering to match operation requirements, and large capital investments are required to ensure successful implementation of this technology.

- *Distributed Power Generation and Energy Storage*
  Installations in locations with significant solar or wind resources can consider using these renewable energy sources in an islandable mode when the main utility grid fails to reduce fuel consumption and improve energy resilience. Solar photovoltaic (PV) arrays or wind farms in combination with an islandable inverter can produce significant power without requiring a fuel supply chain. Since solar and wind power is intermittent, significant usage of renewable power typically requires adequate and properly sized 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. Currently, much of the existing deployed solar PV on DoD installations is installed without islanding capability, preventing use as a true resilience solution.

- *Prime Power Co-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 dedicated 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.

- *Distribution System Hardening*
  Improving installation energy resilience often focuses on backup power generation when the commercial grid experiences a disruption. However, emergency power generation assets are ineffective if the surrounding distribution system is unable to convey power between the generation asset and final point of use. Upgrading distribution system equipment such as switches, power lines, and transformers may be pursued as a standalone solution if backup generation is already adequate, or an integrated solution when new backup power generation assets are implemented.

- *Developing Technologies*
  Other new energy technologies (e.g., fuel cells, flywheels, advanced microgrids, etc.) may have a significant future impact for energy resilience on DoD installations. While DoD funding should continue to be allocated for research and development, these systems must be thoroughly tested before wide-scale integration. Premature rollout is extremely

expensive, 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 the DoD will continue to monitor its progress. As with many other new technologies, external partners can provide significant resources and expertise to the Department from development to deployment.

The Department is agnostic towards which specific technology solution is implemented to address an installation's energy resilience gaps, so long as it enhances mission readiness and the installation's ability to maintain or rapidly reestablish mission-critical functions. Collaboration between installation and mission personnel is critical in order to implement an appropriate solution. Collaboration between these groups will ensure new assets are properly sized to requirements and cybersecurity, maintenance, and testing requirements are accounted for. As the complexity of solutions increases, particularly solutions leveraging less established technologies, the challenges of integrating these technologies into existing physical and cyber infrastructure increases, and the need for close communication between installation and mission personnel becomes even more paramount.

Energy Resilience in the Services

Army

Army energy and water resilience efforts in FY 2019 strengthened the Army's ability to sustain critical missions during utility disruptions, whether caused by natural events, physical attacks, or cyberattacks. Black start exercises at three installations revealed vulnerabilities that would have been difficult or impossible to discover from tabletop readiness exercises. The development of Installation Energy and Water Plans (IEWP) at installations, slated for completion by FY 2021, will identify ways to reduce risk and assure that energy and water projects are directly tied to installation mission requirements. Initiated in 2017, Installation Status Report – Mission Capacity (ISR-MC) reporting has enabled the Army to build a comprehensive picture of energy and water resilience at installations to measure effects of the resilience planning and installation-level resilience projects and initiatives.

Installation Security and Resilience Scenarios

Following the successful black start exercise at Fort Stewart in June 2018, the Army conducted three additional black start exercises in FY 2019. Black start exercises entail the compromise or simultaneous loss of utility power to part or all of an installation, where backup generation similar to prime power must run at full operational load for an extended period. These exercises allow installations to identify capability gaps ranging from minor to critical concerns. The black start exercises were conducted at Fort Greely, Fort Knox, and Fort Bragg. Areas identified for improvement included communications, backup power systems (e.g., legacy diesel-generator or photovoltaic power generation systems), switching to battery backup power and back to grid power

after the grid is re-energized, operation of various power inverting and mission support equipment, and the resilience of auxiliary locations.

- Fort Greely unplugged from the grid for five and a half hours to test its energy systems.
- Fort Knox tested backup systems by shutting off power to localized portions of the installation, followed by a two-hour shut down of the entire installation.
- Fort Bragg conducted an unannounced resilience test by shutting off power to the installation for 12 hours during a parallel exercise testing deployment readiness of the Global Response Force.

In addition to the planned black start exercises, Fort Hunter Liggett used black start exercise techniques for a utility-scheduled power outage after the utility provider notified the installation of a 12-hour repair to power lines. Under short notice, the installation used a black start exercise checklist developed by OSD and MIT-LL to prepare for the outage.

Installation Energy and Water Plans (IEWP)

The Army's IEWP requirement leverages the Army Directive 2020-03 (Installation Energy and Water Resilience Policy) and DoDI 4170.11 to emphasize security and resilience as the overarching installation planning and project development themes. The genesis of this effort was a FY 2016 OSD task to the Army to plan installation energy, but the Army has taken this as a strategic opportunity for the Army to integrate current priorities with historical planning efforts. The Army's lessons learned and programmatic focus on energy and water conservation and efficiency can be traced to the Net Zero programs and efforts. These efforts continue to benefit the Army through reducing risks and operating costs. The IEWP planning process requires stakeholder and leadership coordination to ensure that energy and water projects and best management practices are directly tied to the installation mission requirements. The Army mission is supported by a diverse set of critical activities, including training, command and control, mobilization and deployment, manufacturing and maintenance, and managing large grounds where soldiers and civilians live and work. Army resilience planning focuses on a broader area, to ensure the complete strategic support to the entire installation and diverse set of missions. The key attributes of a resilient installation are assured access to energy and water, sustainable condition of energy and water infrastructure, and effective system operation. Army IEWP Guidance signed on 26 July 2018 provides a technical approach to the IEWP process. The Army IEWP planning process is a continuous five-step process: (1) identify requirements; (2) assess installation risk and opportunities; (3) generate operational or project solutions centered around the installation's missions; (4) use the installation profile, security and risk assessments, opportunity assessments, and energy and water efficiency strategies to ensure that energy and water planning best supports installation mission objectives; and (5) execute and evaluate the IEWP using available information from ISR-MC and Army Energy and Water Reporting System (AEWRS), to validate installation progress towards energy and water goals. Initial IEWPs for all Army installations are scheduled to be completed by the end of FY 2021. In FY 2019, the Army commands reported completion of

eight IEWPs, and 11 undergoing final reviews. Approximately 30 IEWPS were identified for completion during FY 2020 - 2021 and have been initiated.

Installation Status Report – Mission Capacity (ISR-MC)

To understand and mitigate risk to missions at installations from an energy or water disruption, the Army is using the ISR-MC to assess energy and water security and resilience. The Installation Status Report is the Army's database of record, deployed since the 1990s, and is used as a decision tool for senior leaders in developing cost requirements, readiness support, and modernizing installations. ISR is a mature process and the tool for communicating installation asset status up the chain of command.

The section of ISR-MC focused on energy and water resilience includes 34 energy-related measures (electricity, natural gas, other) and 34 water-related measures (potable water and wastewater). The ISR-MC measures were developed in FY 2017 to align with the requirements of Army Directive 2020-03 (Installation Energy and Water Resilience Policy). Metrics evolved, and reporting was incomplete in FY 2018, so FY 2019 represents a milestone with a complete second year of data outlining the resilience posture of Army installations.

In total, these ISR-MC measures build a comprehensive picture of energy and water resilience at installations that can be used at Army's tactical, operational, and strategic levels. At a tactical level, this measurement framework provides the basis of the IEWP requirement, and uses the ISR-MC data for project justification. At the operational and strategic levels, this allows the Army to see risk across the enterprise and direct resources to its biggest problems. This reporting effort allows the Army a clearer picture at an enterprise and enables prioritized investments to mitigate the greatest risks to readiness.

Notable Army Initiatives

Some notable projects that contributed to Army installation resilience include the following:

- Fort Riley installed a generator powering a mission support facility using Sustainment, Restoration, and Modernization (SRM) funds. The project provided a 600 kW, three-phase, natural gas-powered generator and a weather-resistant enclosure.
- Holston Army Ammunition Plant (AAP), Lake City AAP, Radford AAP, Pine Bluff Arsenal, Fort Gordon, and Military Ocean Terminal Sunny Point upgraded building controls to a Utility Monitoring and Control System (UMCS).
- Fort Bliss implemented recommended re-tuning measures to its building automation systems (BAS). Building controls increase efficiency and reduce building loads, which allows facilities to avoid over-sizing and over-spending when implementing resilience projects.
- Lake City AAP, McAlester AAP, and Radford AAP performed Army Metering Program installations. Fort Gordon connected 580 electric, natural gas, and water meters to a meter data management system (MDMS) through UMCS, and Fort Detrick connected 161

meters. Metering is a key element of tracking and understanding energy use, allowing installations to identify the loads of critical missions and plan resilience projects accordingly.

Utility Outages

The Army experienced 944 unplanned utility outages in FY 2019, 152 of which lasted eight hours or longer. Of the total number of unplanned outages, 330 were due to an act of nature, 340 due to equipment failure, and 274 due to other causes. Most outage events (830) were disruptions to electricity. The majority of outage events were the result of on-base causes (704). The Army will continue to track utility outage events so the information can be used to identify trends and enable targeted investment towards energy resilience solutions. The Army seeks to decrease the number of unplanned utility disruption events to improve mission assurance.

Navy

In 2019, the Navy published an "Installation Energy Planning Guide" to integrate installation energy planning efforts with master planning processes and web-based tools. Installation energy planning starts with the DoN Energy Security Framework defining resilience, reliability, and efficiency to meet mission needs. Mission Assurance assessments are a critical input in the installation energy and water planning process and inform the prioritization of energy security gaps and the technical solutions developed to address them.

The Navy completed IEPs for its top 15 installations as required in the FY 2019 NDAA. The process and data required to produce these documents has already led to increased coordination among installation stakeholders and increased visibility of both energy and mission requirements. The Navy intends to regularly update these documents and integrate them into the rest of the Installation Energy program.

As an example of this integration, CNIC is incorporating the energy security gaps and vulnerabilities section of the IEPs into its Energy Mission Integration Group (EMIG) process. IEPs provide a complete picture of the installation's energy posture, and a command-endorsed list of energy security gaps. The Navy EMIG governance process identifies and prioritize these gaps across the enterprise, based on Mission Assurance and the input from multiple mission owners, systems commands, and executive-level leadership. Once the enterprise gaps are prioritized, EMIG tasks NAVFAC with analyzing the most appropriate and cost-effective acquisition strategy to mitigate the highest-priority gaps. EMIG then approves these courses of action and the required resources to complete these mitigation strategies in a timely manner.

A significant undertaking and accomplishment in FY 2019 involved the design and development of the CNIC N4 Energy Tool Suite. CNIC created this web-enabled, user-friendly tool suite bringing consistency to how energy data is collected, analyzed, and reported. The N4 Energy Tool

Suite consolidates data from external sources such as DUERS,[8] INFADS,[9] and CIRCUITS[10] with user-inputted data, allowing users to review and track aggregated data in one central location. Data aggregated in this effort includes FRCS and advanced meter infrastructure (AMI) inventories, gap analysis, project management, geographic information systems (GIS), forecasting, and IEPs. This web-enabled data management system streamlines data collection requirements to reduce duplicative data calls and workload for installation- and region-level energy professionals.

As of FY 2019, Navy has installed 15,968 AMI meters. Navy conducts weekly progress meetings to track implementation and connection status across each FEC.

Notable Navy Initiatives

IEPs set the pace for energy resilience activities in the Navy. By identifying and prioritizing energy security gaps, and then eventually programming projects to close those gaps, the IEPs ensure installation leadership fulfills the intent of the CNIC Energy Guide in pursuing mission assurance through energy security.

In FY 2019, the Navy awarded multiple new energy resilience projects and commissioned previously awarded projects at installations around the world. As the DoN center of excellence for the execution of third-party financing, ESPO had a cumulative award of more than $1.4B awarded in ESPCs, UESCs, Intergovernmental Support Agreements (IGSAs), EULs and PPAs at the end of FY 2019.

The Navy commissioned its first onsite solar PV PPA at Joint Base Anacostia Bolling (JBAB). This system awarded in 2015 includes 7.1 MW of capacity across four sites – three carports and one ground-mounted site. This project required collaboration among DoN, DoD, DoE, the National Renewable Energy Laboratory (NREL), D.C. Sustainable Energy Utility, and private sector utilities and ensures resiliency, reliability, and efficiency.

The Navy awarded its largest ever ESPC to Naval Station Guantanamo Bay, Cuba, to build a new power plant, improve resiliency and reliability, increase efficiency, and add renewable generation to this self-sufficient critical installation.. This new power plant will be the Navy's first to use liquefied natural gas (LNG) and will become the installation's primary power generating facility. The existing diesel generator complex will become a subsidiary system to ensure consistent power supply and serve as a backup system in the event of planned or unplanned outages. Annual savings for this ESPC are expected to reach nearly four million British thermal units (BTU) and 1 million gallons of water. Additionally, approximately 17 percent of the power produced by this plan will be from renewable energy sources.

Other notable resilience activities across the Navy include tabletop exercises to test reliability and resiliency at JB Pearl Harbor Hickam and NSB Kings Bay, deployment of hybrid technology

[8] Defense Utility Energy Reporting System
[9] Internet Navy Facilities Asset Data Store
[10] Centralized and Integrated Reporting for the Comprehensive Utilities Information Tracking System

at Hawaii and other Pacific installations, and repair and replacement of high-voltage distribution systems at Naval Station Rota, Naval Base Kitsap, and NAS Oceana.

Utility Outages

The Navy continued to improve reporting and tracking of utility outages in FY 2019 and repeated analysis of this data year over year will help to systematically inform future investment decisions. The Navy reported 1,076 unplanned utility outages in FY 2019, 158 of which lasted eight hours or longer. Of the total number of outages, 261 were due to an act of nature, 575 due to equipment failure, and 240 due to other causes. All reported outage events were disruptions to electricity. The majority of outage events were the result of on-base causes (984).

Marine Corps

The USMC is ensuring energy security planning, collaboration, project execution, and program management with a focus on providing energy for mission assurance, continuity of operations, and sustainment of critical installation services.

Policy Letter 9-19 Installation Energy Security, issued on October 15, 2019, requires installations to perform energy security planning in order to enhance installation resilience and mission assurance. The new policy incorporates a collection of recent Congressional, DoD, and DoN mandates and policies while leveraging existing Marine Corps risk management, planning and assessment programs.

The USMC established an annual assessment program to evaluate Installation Energy program performance. The Annual Energy & Water Management Report assesses each installation's ability to provide reliable, resilient, and efficient energy, and required a deep dive into energy generation assets, long-range planning efforts, and coordination with mission owners in addition to traditional energy project execution and conservation efforts.

The USMC developed an Installation Energy Security Plan (IESP) framework structured to identify and prioritize energy security gaps, explore solutions, monitor implementation plans, and measure performance against established benchmarks. USMC installations will begin using the framework in FY 2020.

Notable Marine Corps Initiatives

- The USMC completed a $91M ESPC project at Marine Corps Recruit Depot (MCRD) Parris Island. The comprehensive energy resilience and infrastructure modernization project features a new combined heat and power plant, full system back-up (power and steam) and on-site power generation and storage, centrally operated by a cutting-edge microgrid control system.
- Marine Corps Air Station (MCAS) Miramar completed construction and began testing on an installation-level microgrid. This project constructed a power plant with both diesel and natural gas generation to supplement existing landfill gas and solar power, providing a total of 11.2 MW of on-site power generation. Additionally, a new energy and water operations

center was built to consolidate the microgrid control system with other utility management systems at the air station.

- Marine Corps Logistics Base (MCLB) Albany continued its design review of a previously awarded $46.8 million ESPC. When completed, the ESPC will include a new microgrid with secure networking and SCADA system, upgraded electrical distribution components, a new landfill gas (LFG) generator fully integrated into the grid system's architecture, and the addition of black start capability to an existing government-owned LFG generator.

Utility Outages

The USMC reported 217 unplanned utility outages in FY 2019, 82 of which lasted eight hours or longer. Of the total number of outages, 93 were due to an act of nature, 110 due to equipment failure, and 14 due to other causes. Most outage events (195) were disruptions to electricity. The majority of outage events were the result of on-base causes (207).

Air Force

The Air Force's mission is to fly, fight, and win in air, space, and cyberspace. However, the enterprise's increasing dependence on a system of systems (SoS) network that continues to grow in scale and complexity exposes the Air Force to greater risks from disruptions to enabling systems like energy and water. To reduce its exposure to threats from this changing environment, the Air Force has adopted a new operating posture which establishes resilience as the driving force behind efforts to address enabling system vulnerabilities. This resilience posture is built on the concept of the 5Rs of Resilience: Robustness, Redundancy, Resourcefulness, Response, and Recovery. The dynamic 5Rs approach to resilience captures the multi-faceted characteristics that are needed to create a true mission resilience profile. With the operating environment becoming increasingly dependent on enabling systems – and therefore susceptible to its interruption – this plan enhances the Air Force's capacity to identify, assess, and mitigate resulting vulnerabilities through a focus on resilience.

IEPs are a key part of Air Force efforts to enhance mission-wide resilience throughout the enterprise. IEPs provide an important decision-making structure to define energy mission requirements, incorporate long-term plans for energy resilience capabilities, and ensure reliable and available utilities for installation critical missions. Air Force IEPs address missions, existing plans (e.g., Installation Master Plan), particular circumstances, priorities and constraints. They include:

- Avenues for and means to meet projected future energy and water demands to achieve mission assurance;
- Alignment of goals set by Congress; and
- Concerns that hinder stakeholders' cooperation on energy and water management including industrial control system and cybersecurity.

Air Force installations are given tools to help implement emergency management exercises, which include outage scenarios lasting longer than the typical three to five day outages. This is done to

assess impacts and identify mitigation and remediation strategies for assuring mission readiness. In many cases, the exercises include off base partners, such as the municipal and county emergency services and utility providers. Lessons learned from Air Force staff and installation participation in North American Electric Reliability Corporation's GridEx IV, other outage exercises, and real world events continue to shape the Air Force way forward.

Fundamentally, energy assurance means having required power where and when it is needed. Inherent in energy assurance are reliability and availability metrics for installations energy systems. Recently revised Air Force Manual 32-1061, Providing Utilities to U.S. Air Force Installations, allows more coherent reporting and analysis of energy system performance. Current reporting only provides quantity and duration of outage incidents based on commodity type, location, and cause. The Air Force is considering adopting commercial standards methods that yield more pertinent system reliability and availability data for internal and external comparisons.

Notable Air Force Initiatives

The Air Force now has over 140 energy resilience initiatives in development. The following are some examples of Air Force-led initiatives:

- IEPs: The Air Force is currently engaged in its second round of IEP workshops, with three installations (Beale AFB, JB McGuire–Dix–Lakehurst, and JB Elmendorf–Richardson) having completed their IEPs. The Air Force's IEP Energy Resiliency Dashboard will be the interface that enables data entry and management and provides a visual representation of an installation's energy resilience posture. It will enable the future development of IEPs. The IEP model and dashboard will be operational and available on the Comprehensive Planning Platform in FY 2020.
- Community Partnerships for Resilience: Community partnerships continue to be pursued between bases and communities, such as Colorado Springs, CO; Tucson, AZ; and Warner Robins, GA. The effort between Warner-Robins AFB, GA and Georgia Power is advancing the initiative to build a 139 MW photovoltaic array on land released by Robins AFB from Air Installation Compatible Use Zone encumbrance, and to connect four substations on base to allow the two Georgia Power-owned 80 MW combustion turbines to connect to the off-base grid. Currently, construction has begun on new transmission lines. In the event of a local or regional grid outage, Georgia Power will feed the base and local community power from either the PV array or the combustion turbines. There is no additional cost to the government for either the PV array or the substation connections. The Air Force is encouraging all installations to establish similar partnerships where feasible and is developing tools to assist them.
- Battery Energy Storage System (BESS) Project: Vandenberg AFB, CA is exploring a BESS project for possible incorporation into their Vandenberg Solar I solar generating station. This evaluation continues and is expected to be completed in FY 2020.
- Energy as a Service: The Energy as a Service initiative continues for Altus AFB, OK and Hanscom AFB, MA. The goal continues to be a realignment of the Air Force approach to

energy procurement and management functions via a contractual vehicle for comprehensive energy solutions delivered by a single provider for an installation. The concept goal is to have the Energy as a Service provider as the sole responsible party executing investment, and operation of the entire on-base utility system.

- Third Party Finance: In FY 2019 the Air Force partnered with DLA to award an ESPC supporting all aspects of JB San Antonio, TX including Lackland, Fort Sam Houston, Randolph, Kelly, Camp Bullis, and Medina Annex. This $142.7M task order leverages $2.7M of Facility Sustainment, Restoration, and Modernization (FSRM) up-front direct investment. Under the terms of this task order, approximately 900 buildings totaling 14,700 thousand square feet (KSF) will receive energy conservation upgrades that increase energy efficiency, reliability, and resiliency. The implementation of this third party finance project will bring JB San Antonio approximately 15 percent in overall energy savings and five percent in water savings.
- Project Examples:
    - Due to its isolated location and harsh climate, Eielson AFB has always implemented resilience as part of its operating culture. The base operates its own utility plants and infrastructure. In FY 2019, Eielson AFB continued to sustain its unique utility infrastructure and continued expansion for the new F-35 mission. A $57M MILCON project to extend the utility corridor system to the South Loop began construction in FY 2018. The new utility line will improve utility distribution to existing facilities on the South Loop and accommodate the new loads from new F-35 construction and mission. Over $16M of existing utility upgrades were also completed, which will add reliability to the existing distribution system. Continued utility projects are expected in the coming years. FY 2019 saw the continuation of F-35 mission construction, which will bring additional personnel and energy demand to Eielson AFB. As the base grows, properly maintained and right-sized combined heat and power (CHP), water, and wastewater plants will be imperative to meet the demands of the base.
    - The Hanscom AFB 4.6 MW CHP plant construction was completed in November 2019 and is awaiting to be commissioned. Hanscom AFB is also working with OEA, the Massachusetts Clean Energy Center, and local utility providers to implement microgrid strategies on base.
    - Barksdale AFB, AFCEC, and OEA are working together to enable the construction of a utility-owned and operated electric peaking plant on the installation. The plant will normally operate as a peaking turbine and as the primary electrical source for Barksdale during an extended outage. This effectively islands the base. The plant will also provide a black start capability for the utility (i.e., the ability to start other power plants on the grid).

Utility Outages

The Air Force experienced 252 unplanned utility outages in FY 2019, 131 of which lasted eight hours or longer. Of the total number of outages, 51 were due to an act of nature, 143 due to equipment failure, and 58 due to other causes. Most outage events (179) were disruptions to electricity. The majority of outage events were the result of on-base causes (230).

Defense Agencies

In FY 2019, the Defense Agencies continued to pursue opportunities to improve installation energy resilience.

DeCA

- Electricity is a major utility vulnerability because of DeCA's refrigeration requirements. DeCA has small generators to support the front-end cash register systems along with minimal lighting to assist customers checking out of the store during power outages. It has installed permanent large manual transfer switches capable of feeding all refrigeration systems. When needed, this expedites connecting an emergency generator.
- DeCA has processes in place to reduce risk and to minimize product loses during outages, such as covering or removing refrigerated product from the open refrigerated display cases. It has contracted, via its maintenance contractor, the service to provide large portable generators capable of providing power to DeCA refrigeration systems or whole stores during extended emergency power outages.
- DeCA has installed permanent generators at DeCA locations when it is determined that the risk based on the history of electrical service interruptions (storms, brownouts, etc.) can potentially exceed the high cost of installing a permanent generator to handle DeCA refrigeration requirements.

DIA

- In FY 2019, DIA encountered weather-related power outages at the Charlottesville locations and has reduced the negative impact by replacing and adding UPS for its missions.
- DIA is pursuing an energy resilience initiative for a 10.09 MW solar car-ports PV system. DIA will work to design the PV system so that it continues to operate during an electrical grid outage, and thus provide DIA with increased energy resilience by reducing the amount of diesel fuel used by DIA's backup generators.
- DIA participates in a Demand Response program, which helps protect the reliability of the local electricity grid. When the local electrical utility experiences a high demand period, DIA benefits through a bill credit by not operating non-critical loads.

DLA

- Defense Supply Center Columbus (DSCC) has multiple ways to ensure energy systems have redundancy and will keep the buildings operating in the event of an energy disruption. DSCC has a substation on base that has two separate 138 kilovolt (kV) feeds into it. If one of the feeds goes down during an unforeseen event, DSCC has backup redundant feed. DSCC makes it a point to install backup generators at all its mission critical buildings. DSCC performs routine maintenance on these generators and runs them periodically to ensure they are in working order.
- The advanced metering system and energy management control systems (EMCS) installed at DSCC allow base personnel to monitor issues that may occur and troubleshoot problems.
- Defense Supply Center Richmond (DSCR) conducted an Energy Resilience Study. The study included suggestions for increasing the reliability and continuity of the utility system in times of a natural or man-made emergency. Those suggestions are currently being considered and planned for future funding and implementation. In 2020, an Energy Management Plan will be finalized for the installation and will include recommendations addressing actions to improve cybersecurity and FRCS.
- Most buildings at Defense Distribution Depot Susquehanna (DDSP) have permanent generation where critical loads have been identified. Several additional buildings that have been identified as having critical aspects have had portable generator connections installed. DDSP plans to install permanent generators at those buildings that have a significant risk.
- DDSP has added additional UPS capabilities for control systems and other electronic systems that typically experience high failures during power outages.
- Many of DDSP heating systems have dual fuel capability allowing for natural gas or fuel oil operation, providing greater operating flexibility while reducing operating cost.
- A project was completed at DDSP to allow for alternate switching of the substation transformers to run the installation from a common transformer in the event of a single transformer failure, providing a significant increase in the redundancy of the system.

MDA

- As a tenant organization, the MDA supports the host installations' efforts to test energy resilience systems and to pursue self-generated electricity or renewable energy projects where possible.
- MDA facility engineers conducted several Technical Interchange Meetings (TIM) this year at host installations in Alaska and Hawaii to enhance power reliability and energy resilience leading to improved mission assurance. Projects identified during the TIMs were prioritized for implementation as funds became available. Representative TIMs included:
    - Redundancy and Diversity Power TIM at Fort Greely, AK focused on identifying power redundancy and diversity projects in the Missile Defense Complex to enhance power reliability and improve mission assurance. The two highest priority projects are being implemented to increase power redundancy via redundant and diverse feeders.

- Power TIM at Eareckson Air Station (EAS) Shemya Island, AK to identify power improvement projects to enhance power reliability and help increase Air Force and the MDA's mission assurance at EAS.
- Power TIM for the MDA Aegis Ashore Deckhouse and Launch Facility (LF) at Pacific Missile Range Facility in Kauai, HI to identify power improvement projects to enhance power reliability and increase mission assurance. The highest priority project identified to enhance mission assurance was implemented, converting the LF to a solidly grounded system from a high resistance grounded system.

NGA

- NGA continued to evaluate and prioritize energy resilience to enhance mission assurance in FY 2019. Energy resilience activities conducted in FY 2019 included:
  - Programmable Logic Controller (PLC) switchgear upgrade and annual testing of emergency generators
  - Installation of Automatic Transfer Switches (ATS) to allow electrical maintenance to be performed on substations while transferring mechanical load, significantly reducing equipment outages
  - UPS battery replacement and upgrade
  - Fire alarm software upgrade for to increase fire suppression control system
- NGA continued to participate in an electricity demand response program and natural gas curtailment program with its local utility service providers.

NRO

- Since the NRO is highly dependent on energy for the execution of its mission, the NRO continues to work towards a high standard of energy resilience. Examples of projects aimed at increasing the NRO energy resilience include:
  - Installation of new backup generators. Each backup generator is connected to a separate commercial feed and as one or both of these feeds are interrupted, the backup generator(s) will start up to supply that energy source to their facility load.
  - Updating the uninterruptible power system and installing load banks to better test the electrical infrastructure. The NRO has replaced aging power distribution units (PDU) and added additional PDUs to configure data centers for complete redundancy from the PDU.
  - Installation of the Advanced Facilities Network (AFN) project, which will allow additional network metering of unit substations, main distribution panels, and data center PDUs.

NSA

- The NSA experienced minor utility outages during FY 2019. NSA has taken great measures to safeguard against energy supply disruptions and continues to look for ways to further strengthen reliability through redundancy and continuity initiatives. Operator training, checklists, and OM&T of current generation are all efforts NSA uses to ensure reliability and resiliency. Currently, NSA plans to submit several future renewable energy and energy resilience projects (e.g. microgrids, renewable integration or storage, cyber-related efforts, etc.) for ERCIP funding. These proposed projects will be evaluated from both an energy conservation basis as well as from an energy resilience basis.

WHS

- WHS continues to pursue energy resilience initiatives to improve mission assurance and support the warfighter. WHS is using third-party financing vehicles at two installations to investigate opportunities and implement solutions to improve the agency's ability to respond to energy disruptions. Potential solutions under consideration include peak shaving generators and solar PV.
- WHS continues to plan for and execute regular generator tests in accordance with OSD OM&T guidance.

4. Cybersecurity and Facility Related Control Systems (FRCS)

The NDS specifically highlighted the threats faced by the Department's Control Systems (CS), particularly those supporting Defense Critical Infrastructure (DCI). CS in DoD are subject to a growing range of cyber threats as these systems have increasingly become more automated and connected. Vulnerabilities and risks for the DoD have increased exponentially as a result of the integration of network-based building management systems, internet of things (IoT) devices, and the connection of legacy control systems such as SCADA into these networks.

Cybersecurity threats to FRCS are not only a DoD issue. Attacks such as "Stuxnet," "Black Energy," and "Crashoverride" were specifically designed to attack the CS of both commercial and civil-owned infrastructure enterprises around the world. As multiple industry and government advisories have publicized, CS are an active target for cyberattacks such as ransomware, Distributed Denial of Service (DDoS) attacks, and malware tailored to CS, which could degrade or deny operations. The "Black Energy" campaign and "HAVEX" malware attack were specifically designed to exploit control systems at the device level; "Flame" and "Duqu" malware exploits physically destroyed control systems front-end IT servers and workstations; "TRITON" was designed to specifically target the industrial safety systems (SIS), or fail safe control systems, used predominantly in the oil and gas industry; and the Ukraine electric grid attack demonstrated the capability to cut power to mission critical facilities.

Unfortunately, despite repeated warnings and highly-publicized accounts regarding attacks, many system operators and owners do not believe their systems are under significant threat. As a result, throughout the entire national power infrastructure enterprise, many utilities and associated industries have not focused enough resources and attention on eliminating vulnerabilities that stem from gaps in user knowledge, ineffective application of cybersecurity frameworks, poor monitoring of systems for exploitation, and limited, if any, recovery programs. Billions of dollars have been spent over the last decade to secure the broader networks and devices that generate, edit, transmit and store protected health information (PHI) and personally identifiable information (PII) in areas such as the financial markets and healthcare industry. While these efforts have had limited positive impact on reducing threats, particularly with regards to creating frameworks and technologies that can be leveraged to provide baseline cybersecurity, they still demonstrate progress. The same cannot be said for CS in energy infrastructure.

FRCS supporting the Department's energy infrastructure are essential to performing warfighting capabilities, executing critical missions, and projecting power. DoD FRCS and other CS are actively threatened by adversaries and are highly vulnerable to cybersecurity attacks and failures. The risks to CS increase as more CS devices are connected to networks without appropriate cybersecurity protections.

The Department has begun to take steps within the CS environment to reduce vulnerabilities and ensure greater security. The NDS explicitly highlights the need for secure and resilient CS to provide for warfighting capabilities, execute critical missions, maintain operational readiness, and project power. In FY 2018 the Joint Chiefs of Staff (JCS) and ODASD(DC&MA) published

updated DoD Joint Mission Assurance Assessment (JMAA) Benchmarks to provide mission assurance stakeholders and mission owners a framework for assessing and cataloging risks to infrastructure, including cyber infrastructure, that impact DCI.

ASD(S) released updated guidance in February 2020 that outlines a process for owners and operators of FRCS connected to the DoD Information Network (DoDIN) to account for operational resilience and cybersecurity defense posture. This FRCS Cybersecurity Plans Guidance memorandum outlines a framework and provides a template for FRCS owners and operators to develop a FRCS Cybersecurity Plan to address CS connected to the DoDIN, as well as systems that are internet-facing or stand alone. The intent of these plans is to assist the DoD Components with building and recording CS inventories and to ensure a standard format for review and oversight across the Department. The DoD Components are actively implementing these plans for FRCS supporting Defense Critical Assets (DCA), Tier 1 Task Critical Assets (TCAs), as well as all FRCS that are connected to the DoDIN, are internet-facing or stand-alone, and which require Authorization to Operate (ATO).

In July 2018 the Deputy Secretary of Defense (DepSecDef) published a memorandum titled "Enhancing Cybersecurity Risk Management for Control Systems Supporting DoD-Owned Defense Critical Infrastructure" that tasks DoD with implementing standardized best practices, improving CS information sharing, advancing cyber assessment capabilities, maintaining CS training, and establishing a reporting requirement to ensure CS cybersecurity accountability. The memorandum also established the role of Principal Cyber Advisor to advise the Secretary of Defense on efforts to enhance the security of DoD CS. Many of the memorandum's requirements are based on existing DoD policy and statutory requirements and the memorandum provides DoD Components with clear expectations for timelines associated with adherence to these requirements. For example, the DoD Components were tasked with applying the National Institute of Standards and Technology Cybersecurity Framework (NIST CSF) and related guidance consistent with DoDI 8510.01 beginning no later than July 30, 2018. U.S. Cyber Command (USCYBERCOM) was tasked with disseminating threat, vulnerability, and mitigation information to all CS stakeholder beginning no later than September 30, 2018. These are just two examples of the thirteen topline requirements laid out in the DepSecDef memorandum.

In December 2018 the DoD Chief Information Officer (CIO) published a memorandum titled "Control Systems Cybersecurity" stating that mission assurance is dependent on the robust cybersecurity of the underlying control systems that support all operations. It is imperative the Department move with deliberate speed to secure its critical control systems through a comprehensive risk management approach to inventory systems, assess vulnerabilities, develop mitigations, and remediate risk. The forthcoming updates to the DoD cybersecurity program, in DoD Instructions 8500.01, 8510.01, and 8530.01 will include the responsibilities outlined in this memorandum and address policy gaps in control systems cybersecurity across the DoD enterprise.

Although not specific to FRCS, in FY 2018 DoD also published the *2018 DoD Cyber Strategy*. Per this strategy, DoD's objectives in cyberspace include:

1. Ensuring the Joint Force can achieve its missions in a contested cyberspace environment;
2. Strengthening the Joint Force by conducting cyberspace operations that enhance U.S. military advantages;
3. Defending U.S. critical infrastructure from malicious cyber activity that alone, or as part of a campaign, could cause a significant cyber incident;
4. Securing DoD information and systems against malicious cyber activity, including DoD information on non-DoD-owned networks; and
5. Expanding DoD cyber cooperation with interagency, industry, and international partners.

As it relates to the cybersecurity of FRCS and the broader DoD CS environment, this strategy aims to:

1. Increase the resilience of U.S. critical infrastructure;
2. Incorporate cyber awareness into DoD institutional culture; and
3. Sustain a ready cyber workforce.

The Department still has substantial challenges ahead of it to address the growing threats to DoD and partner FRCS, but the policies and actions put into place in FY 2018 have created a credible foundation and more apparent path forward for DoD to implement sound cybersecurity processes and technologies to protect its FRCS.

Cybersecurity and FRCS in the Services

Army

Implementation of Army Directive 2020-03 (Installation Energy and Water Resilience Policy) includes efforts to enhance cybersecurity associated with ongoing facility operations. Army installations have robust plans in place to ensure continuity of critical operations in the event of cyberattacks. Directorate of Public Works (DPW) and Army Cyber Command personnel work closely when responding to and recovering from cyberattacks. A critical part of this team effort is the use of the Advanced Cyber Industrial Control Systems (ACICS) Tactics, Techniques, and Procedures (TTP), to guide Army responses. The ACICS TTP also provides procedures that enable ACICS managers and network managers to detect cyberattacks, mitigate the effects on the critical infrastructure, and recover from attacks.

The United States Army's Cybersecurity Plan for FRCS ("the Army FRCS Strategy") provides four key objectives: (1) Inventory Existing FRCS, (2) Assess and Enhance the Cybersecurity Posture, (3) Sustain Effective Cybersecurity, and (4) Ensure Adequate Resourcing. This plan builds on Risk Management Framework (RMF) of DoD Information Technology (IT) principles in the 2014 DoDI 8510.01. The plan was operationalized by EXORD 141-18, Facility-Related Control Systems Cybersecurity, assigning roles and responsibilities across Army key stakeholders.

Other Army FY 2019 FRCS cybersecurity initiatives include developing a threat adversary model and building computer-based training.

Threat Adversary Model

The Deputy Chief of Staff (DCS), G-9, characterized attack scenarios using real-world cases that highlighted how FRCS could be impacted by cybersecurity intrusions. Then, DCS, G 9, quantified the costs for mitigations using the RMF as the standard benchmark of DoD cybersecurity implementation. Finally, the potential cost savings from protecting installation FRCS were determined. This task aligns with the Army FRCS Strategy's Major Target 1.2, "Characterize the system threat environment." Its major outcome is a budget planning tool for installations and characterization of the system threat environment.

A representation of adversary TTP can provide a baseline of metrics that can be used to determine threat levels to an installation. The metrics provide installations with a better understanding of FRCS cybersecurity postures and the applications of RMF controls and remediation techniques that are needed to complete the Army FRCS Strategy. This understanding assures that the risk management (RM) process is applied correctly. Misconfiguration of certain RM processes could lead to compromise of mission readiness.

U.S. Army Corps of Engineers (USACE) Inventory Training

Knowing and understanding potential risks and vulnerabilities across the enterprise is a basic tenet of cybersecurity. Recognizing this, the Army is inventorying all existing Army-owned FRCS. In support of this goal, DCS, G-9, developed computer-based training to teach personnel how to conduct an inventory of all control systems supporting facilities and critical infrastructure using the U.S. Army Corps of Engineers (USACE) Methodology (often referred to as Annex C). The training provides instruction on the identification of control systems and step-by-step guidance for completing this inventory template.

The Army FRCS Inventory Methodology training modules are published on the Army Energy and Water Management Program website. This initiative directly supports Goal 1 of the Army FRCS Strategy, and will result in a more accurate inventory of Army FRCS assets by enabling inventory teams to effectively identify and document FRCS devices.

Navy

The Navy continues to be a leader in FRCS cybersecurity from policies requiring every military construction project to include cyber-commissioning to being a key participant in the More Situational Awareness for Industrial Control Systems (MOSAICS) initiative. As previously mentioned, in FY 2019, the Navy's Energy Program completely revamped many of the data collection and aggregation tools. The new tool suite, hosted on the private portal, integrates current capabilities and includes new requirements like FRCS inventory in addition to AMI inventory and operational status. These upgraded tools provides secure access to EMIG, IEPs, Project Management, Reporting and Forecasting, and User Management data across the Navy Enterprise.

Tool benefits include integration between various Navy Energy data, systems, and processes into a single platform and consistency in collecting, analyzing, and reporting energy program data.

The IEPs along with the FRCS module on Navy private portal enable installations to track and document their compliance with applicable requirements. The Navy's Energy Program supports the multifaceted FRCS cybersecurity strategy. The strategy involves prioritizing the security of Tier 1, 2 and 3 TCAs and their supporting utilities infrastructure, followed by other control systems according to mission criticality. In accordance with the Unified Facilities Criteria (UFC), control system modernization and authorization is also being implemented through ongoing execution of real property facility projects. Additionally, the Navy is pursuing more efficient control system authorization management and cost reduction through a control system standardization strategy. Finally, cybersecurity of Navy control systems is central to the continued development and rollout of the Smart Grid. The IEPs along with the FRCS module on Navy private portal enable installations to track and document FRCS cybersecurity gaps and challenges. The FRCS module on Navy private portal enables the active management and completeness of the control system inventory and categorization of control systems according to the established priorities.

Marine Corps

Throughout 2019, the USMC held a series of FRCS workshops. The intent of these workshops was to bring facilities, IT, and operational technology (OT) experts together at the installation and regional levels to educate stakeholders on FRCS program efforts and to address local concerns surrounding cybersecurity of existing control systems.

In FY 2019, Camp Lejeune secured an ATO for their existing FRCS, allowing more facilities to be brought online and enabling remote monitoring and control of facilities and utilities spread over a 265 square mile area. The ATO relies on devices that cryptographically separate the OT from the Marine Corps Enterprise Network, vice installing a physically separate network, which is cost-prohibitive for such a large installation.

MCAS Beaufort undertook a project with IBM Watson to utilize advanced analytics on data obtained from existing FRCS to improve equipment performance, reduce maintenance costs, and optimize energy resources. This effort involves performing analytics on heating, ventilation, and air conditioning (HVAC) equipment to identify faults and notify the Public Works Department so they can quickly identify and adjust inefficient systems, while the system calculates and records cost savings. This project is an example of how data integration capabilities can be deployed across installations, supporting USMC efforts to reduce operating costs and provide more reliable and resilient services to the operating forces.

Air Force

Industrial control systems (i.e., FRCS) are essential to Air Force core missions as they support critical infrastructure which enables mission capabilities across Air Force installations. Technological advancements have created more efficient control systems but have also opened up

additional avenues for adversaries to attack. Increasing threats to control systems have the potential to degrade Air Force missions. They can physically damage critical infrastructure and serve as a new attack vector to target the broader Air Force network.

In compliance with the NDAA FY 2017, Section 1650, the Air Force is conducting assessments of critical infrastructure to identify vulnerabilities. These assessments are exposing risks to missions that the Air Force was unknowingly accepting while also validating the mitigation measures the Air Force was already pursuing to increase control systems cybersecurity and resiliency. One such mitigation is installing enclaves for network segmentation that logically isolate the infrastructure network traffic.

In an effort to address some of the cross-functional challenges inherent to improving infrastructure cyber resilience, the Air Force is developing a strategy which synthesizes the technical expertise and authorities of several functional communities to enhance existing processes and develop comprehensive, integrated solutions. This strategy will be complementary to defensive cyber operations focused on critical infrastructure. Air Force facility experts have been actively assisting Air Force cyber partners as they develop Mission Defense Teams to focus on defending Air Force infrastructure in cyberspace.

The Air Force is actively changing its culture to emphasize cyber resilience. Next year the Air Force will institute a workforce development program that, in supplement to existing general awareness training required for all Airmen, will provide tailored training and education to all Civil Engineer Airmen who are responsible for the sustainment of Air Force facilities and infrastructure systems.

5. DoD's Progress to Achieve Statutory Energy Management Requirements

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 almost 80 percent of total Federal energy consumption, more than fifteen times the total energy consumption of the next closest Federal agency (the United States Postal Service).[11]

In FY 2019, DoD spent approximately $3.66 billion on installation energy, which included $3.47 billion to power, heat, and cool buildings; and $0.19 billion to supply fuel to the fleet of NTVs. DoD consumed 208,721 billion Btu (BBtu) of installation energy; 201,237 BBtu in buildings (stationary combustion) and 7,484 BBtu in NTV fleet (mobile combustion). The Army was the largest consumer of installation energy, followed by the Air Force, Navy, Marine Corps, and Defense Agencies. Electricity and natural gas accounted for 86 percent of DoD installation energy consumption. The remaining portion of installation energy consumption included fuel oil, coal, steam, and liquefied petroleum gas (LPG). DoD's installation energy consumption mix mirrors that of the U.S. commercial sector, where natural gas and electricity dominate the supply mix.

Energy Consumption

DoD captures installation energy consumption to help promote energy efficiency measures. Figure 3 illustrates recent historical trends in installation energy consumption by DoD Components across all buildings.[12] Installation energy consumption has increased slightly in recent years due to a shift in focus from energy efficiency investments to energy resilience investments, which do not always yield energy savings. Compared to last year, installation energy consumption has decreased.

[11] FEMP, Comprehensive Annual Energy Data and Sustainability Performance [online source] (Washington, D.C. June 1, 2019, accessed April 9, 2020), available from http://ctsedwweb.ee.doe.gov/Annual/Report/TotalSiteDeliveredEnergyUseInAllEndUseSectorsByFederalAgencyBillionBtu.aspx

[12] Energy consumption does not include consumption from NTVs. The Department reported meeting the petroleum reduction and alternative fuel goals in its FY 2015 Annual Energy Management Report to the congressional committees. It continues to participate in efficiently reporting and providing petroleum and alternative fuel vehicle data to Congress and the Office of Management through its Federal Fleet Report, located at the following: https://www.gsa.gov/policy-regulations/policy/vehicle-management-policy/federal-fleet-report. It also reports and publishes progress to these goals through OMB, and the continued progress to meet these goals can be viewed at https://www.sustainability.gov/dod.html.

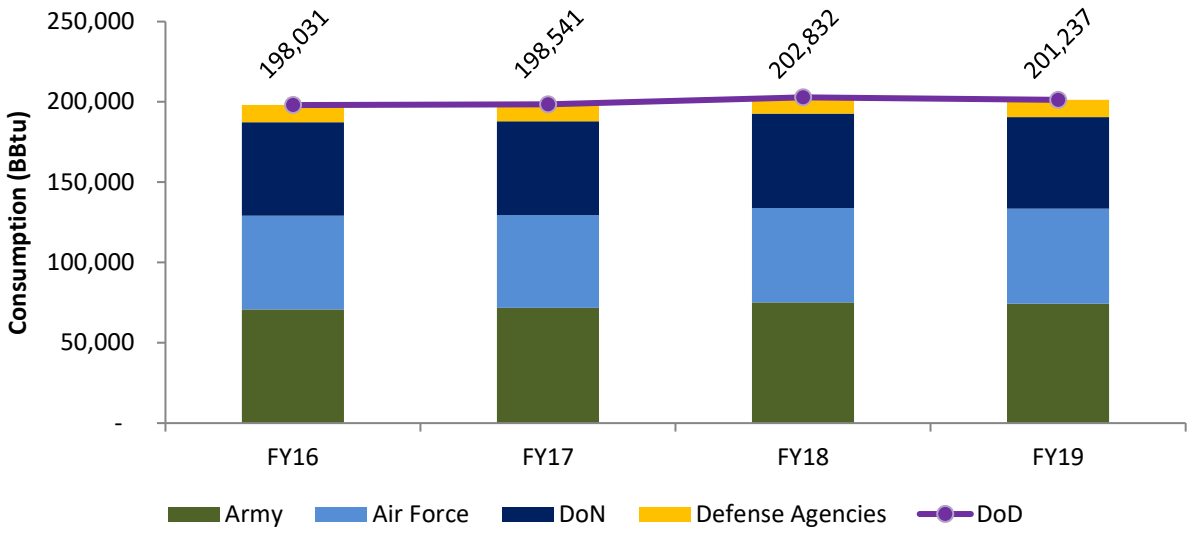

Figure 7: Installation Energy Consumption by Military Service (Excluding NTV Consumption)

Renewable Energy

While DoD pursues renewable energy as an option to advance installation 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: 10 U.S.C. § 2911(g) and section 203 of the Energy Policy Act (EPAct) 2005 (42 U.S.C. § 15852(a)).

Title 10, U.S.C., section 2911(g) established a goal for DoD to produce or procure not less than 15 percent by FY 2018[13] and 25 percent of the total quantity of facility energy it consumes within its facilities by FY 2025 and each FY thereafter from renewable energy sources. DoD progress toward the 10 U.S.C. § 2911(g) renewable energy goal in FY 2019 was 15.6 percent.

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 each FY thereafter. Renewable electricity consumption subject to these requirements was 6.0 percent of DoD total electricity consumption, falling short of the 7.5 percent goal. Figure 5 illustrates DoD progress towards this goal since FY 2007.

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

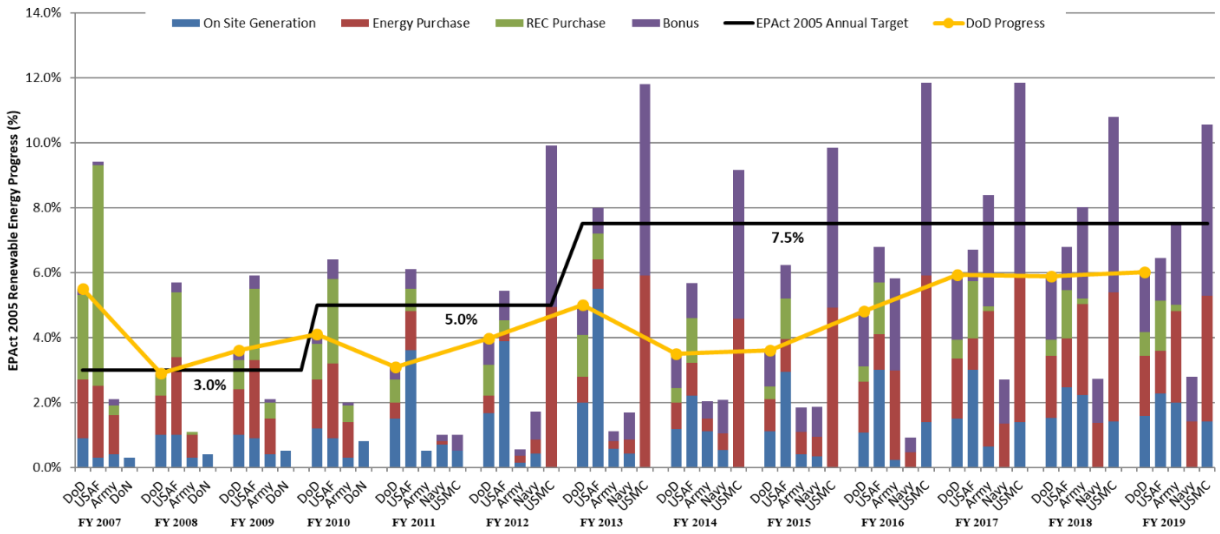

Figure 8: EPAct 2005 Renewable Energy Goal Attainment

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" or "alternative") 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 used to pursue third-party financing of renewable energy projects are Utility Service Contracts (USCs), PPAs, and outgrants. 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.

Army

The Army has made substantial progress and investments to comply with energy mandates. Compliance with prior and current mandates provides a strong foundation on which to build resilience. Efficiency is an important element of resilience as it reduces the cost for implementing resilience. At several Army installations onsite energy storage and generation, including renewable and alternative energy, are components of the Army's energy security and resilience approach. Assured access to reliable supplies of energy and the ability to protect and deliver sufficient energy to meet operational requirements is an explicit goal of Army Directive 2020-03 (Installation Energy and Water Resilience Policy). Onsite generation diversifies utility supply at installations and reduces reliance on commercial grids. The Army pursues onsite energy development for assuring access where it is the most life cycle cost-effective solution. Onsite generation, when coupled with energy storage, can provide Army installations with long-term energy resilience.

The Army identifies and implements cost-effective energy consumption reduction measures that contribute to mission readiness. These measures reduce reliance on commercial energy supplies

and improve the overall energy security of Army installations. The Army's total energy use increased slightly relative to FY 2018 due to factors including Puerto Rico ARNG facilities returning to operation in FY 2019 after periods of closure in the aftermath of Hurricane Maria in FY 2018. The Army will work to reduce energy demand as this can improve the capacity of installations to sustain critical missions during disruptions to the power grid.

Renewable Energy

In FY 2019, the Army increased its renewable energy capacity for the fifth year in a row, maintaining achievement of renewable energy goals. The Army added 9.3 MW of renewable energy capacity in FY 2019 through 40 new projects. The total percentage of renewable electric energy eligible toward the EPAct 2005 goal decreased from 8.0 percent in FY 2018 to 7.5 percent in FY 2019. The renewable energy production credited toward the NDAA 2010 goal decreased by 1.8 percent from FY 2018 to FY 2019.

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 in parking areas; larger projects funded through ERCIP, ESPC, or UESC; and utility-scale projects leveraging private financing through available Federal and DoD authorities. In FY 2019, the Army added 7.6 MW of renewable electricity capacity through a variety of programs that leverage private or third-party financing, such as PPA, ESPC, UESC, or General Services Administration (GSA) area-wide utility contracts. The Army's Office of Energy Initiatives (OEI) facilitates utility-scale projects by leveraging private equity. OEI continues to look for private financing opportunities, focusing on the development of generation projects that include energy storage and controls allowing continuing power support to installations requirements in the event of outage.

In FY 2019, the Army continued its approach of investing in renewable energy where it supports installation mission readiness and makes economic sense using available funding mechanisms.

Programs

ERCIP

The Army continues to focus ERCIP projects on energy resilience requirements for critical missions. Because these types of projects are becoming increasingly complex, the Army recognizes the need for a more structured planning and programming process. In FY 2019, the Army adopted the planning charrette process to reduce changes to projects. The Army will employ this new process for water and energy resilience projects.

UP

The Army uses UP to achieve significant modernization upgrades to energy and water utility infrastructure. UP generally offers a cost-effective pathway for addressing deferred maintenance backlogs in a reasonable timeframe. UP leverages private sector financing and expertise, reduces risks, and transfers liability from the Army to the utility provider. Upgrading infrastructure and operations to industry standards improves energy and water system performance, reliability, and

resilience for Army missions. As of October 2019, 155 installation utility systems have been privatized.

Demand response (DR)

The Army released a DR Guidance and Handbook in December 2018 facilitating installations' participation in DR programs with their electric utility providers or through the DLA's agreement with curtailment service providers. By shifting electricity use during peak hours, installations can lower their utility costs and receive incentives. DR also contributes to readiness by assuring critical missions have access to electricity during periods of peak demand. The Army evaluated market opportunities, identified specific strategies, and conducted site-specific assessments to determine whether DR is a viable opportunity to reduce and manage utility costs. In August 2018, the Army conducted DR training for Energy Managers in support of AEWRS data improvement to track participation and determine its financial impact on utility costs. In FY 2019, there were 17 Army installations participating in the DR program with financial benefits of $3.5 M credited toward the utility bills of the participating sites. The Army avoided 0.5 percent in electric costs through participation in DR this fiscal year.

Army Metering Program

The Army Directive 2014-10 (Advanced Metering Utilities) required installation of advanced electric, natural gas, water, and steam meters in individual facilities to accurately capture a minimum 60 percent of utility use by 2020 with a goal of 85 percent at the site and facility level by the end of fiscal year 2020. While the Army continues to install electric meters, connectivity in reporting consumption to MDMS remains a challenge. In FY 2019, electric meters were installed in more than 49.4 percent of the total number of appropriate buildings identified. However, only 24 percent of total electric energy consumption is currently reporting to the central metering system due to connectivity and sustainment issues. The Army Metering Transition Plan, signed in February 2019, directs a decentralized approach where each Land Holding Command (LHC) executes metering program functions under the management of DCS, G-9.

Navy

The CNIC Energy Guide and supporting guidance (OPNAV 4100.5E and EO 13834) outline the importance of efficiency, reliability and resiliency. This guidance specifies that the Navy continuously improve utility efficiencies, and achieve annual consumption and cost reductions. To accomplish these goals, the Navy has implemented a variety of technological solutions, such as Smart Grid, FRCS, renewable energy sources (solar, wind, geothermal), AMI, and energy storage devices. The Navy encourages the application of best practices and new building standards, such as cool roofs and pavements, improved insulation, Zero-Scaping, and light-emitting diode (LED) light fixtures to improve functionality and tailor efficiencies to specific geographical conditions. Additionally, the Navy promotes the use of energy efficient products, such as Energy Star© appliances for all new construction and renovations.

Navy Energy projects awarded in FY 2019 achieve all or some feature of the Energy Security Framework's three pillars of efficiency, reliability and resiliency. The Joint Base Anacostia-

Bolling solar array and the Guantanamo Bay power plant increased efficiency, improved power reliability and overall installation resiliency. Additionally, the Navy awarded a UESC for energy efficiency measures at numerous buildings at Naval Base Kitsap in FY 2019 that improved power reliability for unique and sensitive equipment.

Numerous training opportunities exist for Energy Program staff. Civil Engineer Corps Officers School (CECOS) provides a Facilities Energy Management Training course. Energy Manager Training Program for Facility Managers, Energy Exchange conference, World Energy Engineering Congress (WEEC), and Certified Energy Manager (CEM) training provide valuable opportunities not just to learn about new technology and processes, but also to interact and network with peers both in the Navy and in industry.

For many years, the Navy has used DUERS as one of the primary tools for the collection, management, and reporting of purchased and produced energy and costs. DUERS collects and transmits periodic utility and energy data for inclusion in the sustainability reports and utility monitoring.

In FY 2019, the Navy established the DUERS board, consisting of CNIC and NAVFAC personnel to provide oversight and strategic direction for the DUERS reporting and validation process and the DUERS user community. The primary goals of this board are to increase awareness of the DUERS reporting and validation process, increase consistency and accuracy of DUERS data, increase accountability at all levels of the reporting and validation process, and monitor or adjust the process as necessary.

Marine Corps

The USMC has helped to modernize facilities and achieve significant energy and water reduction while leveraging private capital to rapidly create resilience on installations.

MCB Camp Lejeune awarded $110M on three task orders (TO) for its UESC with Duke Energy. The first TO focuses on modernizing aging water and wastewater infrastructure, while TOs two and three focus on electrical systems, advanced metering, and other infrastructure improvements to increase reliability and efficiency across the installation. These energy conservation and resilience measures are a major step towards reducing energy consumption and minimizing risk of operational impacts during power interruptions.

MCLB Barstow completed construction on a ten acre solar farm aboard the Yermo Annex, which will reduce the installation's reliance on the commercial grid. Funded through an ESPC, the new on-site generation asset will produce nearly 6,800,000 KWh of electricity in the first year that would otherwise be drawn from the local utility provider.

MCAS Miramar has decreased its potable water use by more than 40 percent compared to the 2007 baseline. The air station has a total of more than five miles of reclaimed water distribution systems, which combined with other water efficiency projects, has allowed the base to save more than 100 million gallons of potable water each year. This achievement is significant considering the high water security risk in this region.

Air Force

In FY 2019, 102 installations increased their energy consumption while 82 decreased it. Harsh winter conditions during the winter of 2019 contributed to energy consumption increases, especially in northeast U.S. regions. Many installations reported that real property corrections contributed to more accurate square footage reporting. The combination of increased consumption and increased square footage negatively impacted energy intensity.

A review of information received from Air Force bases reveal a variety of strategies used to reduce energy consumption. Most often mentioned were continued use of FSRM and ERCIP funds along with ESPC and UESC third-party financing. In particular, funds were primarily used to convert to high-efficacy lighting (HEL) and replace inefficient HVAC systems with newer more efficient systems. Various awareness programs continue to educate and motivate personnel across installations to contribute to energy reductions.

A review of information received from installations where consumption increased indicated more extreme summer and winter conditions. In particular, many bases located in the northeast U.S. region reported harsher winter conditions than previous years. New mission construction or increased mission operations tempo were also contributing factors in several instances. The national trend of low energy costs continues to affect the ability to produce effective energy savings projects when justified on life-cycle costs.

Renewable Energy

In FY 2019, 6.4 percent of the electrical energy used by the Air Force was produced from renewable sources. This represents a decrease of 39,190 MWh from the 6.8 percent in FY 2018. In addition, the Air Force performance toward the title 10 U.S.C. § 2911(g) goal was 7.9 percent for both electric and non-electric energy used in FY 2019.

Major operational renewable energy projects in FY 2019 include a 14.2 MW and a 19 MW solar PV arrays at Nellis AFB, NV using PPA mechanisms; a 28.2 MW solar PV array at Vandenberg AFB, CA using PPA mechanism; a 16.4 MW PPA solar PV array at Davis-Monthan AFB, AZ using an indefinite term Federal Acquisition Regulation (FAR) Part 41 contract mechanism; a 6.5 MW PPA solar array at Holloman AFB, NM using an indefinite term FAR Part 41 contract mechanism with the local utility; a six MW PPA solar PV array at U.S. Air Force Academy, CO; and a three MW PPA solar PV array at Edwards AFB, CA.

Larger government-funded operational renewable projects include: a 3.3 MW wind project at Cape Cod AFS, MA; a 1.5 MW solar array project at Burlington Air National Guard Base (ANGB), VT; a 1.2 MW solar PV array project at Toledo ANGB, OH; a 1 MW solar PV array project at Buckley AFB, CO; a 0.8 MW solar PV array at Wake Island, Pacific; 0.8 MW solar PV array at Eareckson Air Station, AK; a 0.5 MW solar PV array at Fresno ANGB, CA; and a 0.5 MW parking cover solar PV array at March ARB, CA.

Other third-party funded operational renewable energy projects include a 3.5 MW solar PV array and a 2.3 MW landfill gas generation plant at Hill AFB, UT; a seven MW landfill gas generation plant at JB Eielson-Richardson, AK; and EUL projects of a ten MW solar PV array at Luke AFB, AZ; a 30 MW solar PV array at Eglin AFB, FL; a 20 MW solar PV array at AF Plant 42, Palmdale, CA; a 17 MW Solar PV array at JB McGuire Dix Lakehurst - Dix, NJ; and a 13 MW Solar PV array at JB McGuire Dix Lakehurst - Lakehurst, NJ.

Three 1.5 MW wind turbines at JB Cape Cod, MA provided renewable energy for pump and treat facilities to remediate the contaminated groundwater and were jointly funded by the Air Force and U.S. Army.

Ground Source Heat Pump (GSHP) projects within the Air Force totaled 12,268 tons operating capacity, which is equivalent to approximately 6,526 MWh of resilient renewable energy. GSHP projects were executed using various funding sources including ESPC, UESC, and ERCIP.

Mountain Home AFB, ID will continue to develop its geothermal resource by finalizing an Environmental Assessment by the spring of FY 2020 and establishing power requirements for mission critical facilities in support of a resilient baseline geothermal power plant, and will be the pilot for other Air Force geothermal initiatives.

The Air Force developed and continues to manage an aggressive program that forecasts compliance with EPAct 2005 and title 10 U.S.C. § 2911(g) performance targets in the FY 2022 timeframe. More detailed renewable energy usage information can be found in the Air Force "FY19 AEMRR DoD Supplemental Workbook" and the "FY19 Federal Energy Management Program, Greenhouse Gas Sustainability Data Report."

The Air Force has long recognized the significant role that the MILCON program plays in achieving Federal energy resiliency initiatives. Despite FY 2019 fiscal constraints, the Air Force is incorporating renewable energy projects in MILCON building designs.

Renewable Energy Plans

The Air Force renewable energy use was 6.4 percent of its total electrical energy consumption through a mixture of renewable on-base projects and purchased commercial renewable supply. The Air Force renewable energy plan focuses on the development of resilient, cost effective on-base electric and non-electric energy projects that support the mission. The renewable market will continue to be constrained for the foreseeable future by prevailing utility commodity costs and the availability of economic incentives, such as federal, state, and local tax incentives.

Direct Air Force renewable project funding through ERCIP or other Air Force capital sources is very rarely cost-effective when compared to commercial utility rates. This is primarily because the Air Force cannot benefit from tax rebates and incentives. ESPCs and UESCs are considered for the installation of renewable and resilient capabilities and have started to see inclusion in these third-party financed arrangements. In FY 2019, there are a total of ten ESPC and UESC renewable energy projects.

The Air Force has moved toward purchasing renewable power from third-party financed projects developed on bases as the primary strategy to reduce cost and improve base resiliency. The developer can recoup the capital investment by the firm sale of power and by taking advantage of tax credits. Although the government cannot benefit from these financial mechanisms on Air Force owned property, it does benefit by purchasing lower-cost power and gaining dedicated renewable resilience electric supply on-base.

Under EPAct 2005, a third-party developed, on-base renewable project that sells the renewable energy credits (RECs) will not be considered renewable, and thus not count toward the Air Force renewable energy goals. Also, the bonus credit will be lost for on-base renewable generation. A purchase of a lower-cost replacement REC will reinstate the renewable status of the project, as well as the bonus credit. Therefore, purchasing replacement RECs will be a part of the Air Force strategy to meet the aggressive statutory renewable goals but, depending on specific situation, RECs may be included with the project. Nevertheless, RECs remain a useful contingency tool in reaching these long-term legislative mandated targets.

The Air Force seeks opportunities to incorporate renewable energy into resiliency on its installations. Previous studies considered conventional renewable energy opportunities, such as wind, solar, and biomass; but also accounted for passive renewable energy alternatives, such as solar walls, solar water heating, and GSHPs. In FY 2019, the Air Force had approximately 353 renewable energy projects on 115 sites, either in operation or under construction.

Defense Agencies

In FY 2019, the Defense Agencies continued to pursue opportunities to reduce installation energy consumption and increase renewable energy consumption.

DIA

- DIA plans to seek alternative finance projects with energy saving projects that cannot be met with appropriated funding sources. These energy projects would be financed either through an ESPC or UESC.
- DIA's primary renewable energy source in FY 2019 was a 500 kW roof-mounted solar PV array, completed in FY 2016 as part of an ESPC. The solar PV array produced over 749 MWh in FY 2019, and has greatly increased DIA's use of renewable energy.

DLA

- DLA's FY 2019 energy projects continued to focus on energy efficiency improvements embedded as part of renovation projects. DLA implemented a number of efficient lighting, controls, and HVAC projects. Examples of some projects in FY 2019 include lighting replacements with LED and occupancy sensors, replacing aging HVAC systems, and replacing aging EMCS to automate the scheduling of setback, reset, and holiday schedules.

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Appendix A - List of Acronyms

Acronym	Definition
AAP	Army Ammunition Plant
ACICS TTP	Advanced Cyber Industrial Control Systems Tactics, Techniques, and Procedures
AEMRR	Annual Energy Management and Resilience Report
AEWRS	Army Energy and Water Reporting System
AF/A4	HQ USAF Deputy Chief of Staff for Logistics, Engineering, and Force Protection
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFIMSC	Air Force Installation and Mission Support Center
AFN	Advanced Facilities Network
AMI	Advanced Meter Infrastructure
ANGB	Air National Guard Base
ARE	Navy Assistant Regional Engineer
ARNG	Army National Guard
ASA(IE&E)	Assistant Secretary of the Army for Installations, Energy and Environment
ASD(Sustainment)	Assistant Secretary of Defense for Sustainment
ASD(EI&E)	Assistant Secretary of Defense for Energy, Installations and Environment
ASN(EI&E)	Assistant Secretary of the Navy for Energy, Installations and Environment
ATO	Authorization to Operate
ATS	Automatic Transfer Switch
BAS	Building Automation Systems
BBtu	Billion British Thermal Units
BESS	Battery Energy Storage System
BOS	Base Operations Support
Btu	British Thermal Unit
CECOS	Civil Engineer Corps Officers School
CEM	Certified Energy Manager
CIO	Chief Information Officer
CIRCUITS	Navy Centralized and Integrated Reporting for the Comprehensive Utilities Information Tracking System
CNIC	Commander, Navy Installations Command
CNIC N4	CNIC Facilities and Environmental Department
CNIC N44	CNIC BOS Programs
CNIC N441	CNIC Energy and Utilities Branch
CNO	Office of the Chief of Naval Operations
COMMCICOM	Commander Marine Corps Installations Command
CONUS	Continental United States
CS	Control System
DASA(E&S)	Deputy Assistant Secretary of the Army for Energy and Sustainability
DASA(IE&E)	Deputy Assistant Secretary of the Army for Installations, Energy, and Environment

Acronym	Definition
DASD(Energy)	Deputy Assistant Secretary of Defense for Energy
DASN(I&F)	Deputy Assistant Secretary of the Navy for Installations & Facilities
DCA	Defense Critical Asset
DCI	Defense Critical Infrastructure
DC I&L	USMC Deputy Commandant for Installations and Logistics
DCMA	Defense Contract Management Agency
DCS	Deputy Chief of Staff
DDoS	Distributed Denial of Service
DDSP	DLA Defense Distribution Depot Susquehanna
DeCA	Defense Commissary Agency
DepSecDef	Deputy Secretary of Defense
DERB	Defense Energy Resilience Bank
DFAS	Defense Finance and Accounting Service
DIA	Defense Intelligence Agency
DLA	Defense Logistics Agency
DoD	Department of Defense
DoDD	DoD Directive
DoDI	DoD Instruction
DoDIN	DoD Information Network
DOE	Department of Energy
DoN	Department of the Navy
DPW	Directorate of Public Works
DR	Demand Response
DSCC	DLA Defense Supply Center Columbus
DSCR	DLA Defense Supply Center Richmond
DUERS	Navy Defense Utility Energy Reporting System
DUSD(I&E)	Deputy Under Secretary of Defense (Installations and Environment)
EAS	Eareckson Air Station
ECIP	Energy Conservation and Investment Program
EIA	Energy Information Administration
EMCS	Energy Management Control System
EMIG	Navy Energy Mission Integration Group
Energy, HPD	Navy Energy Headquarters Program Director
EO	Executive Order
EPAct 2005	Energy Policy Act of 2005
ERA Tool	Energy Resilience Assessment Tool
ERCIP	Energy Resilience Conservation and Investment Program
ERTTX	Energy Resilience Tabletop Exercise
ES^2	Army's Energy Security and Sustainability Strategy
ESPC	Energy Savings Performance Contract
ESPO	Navy Energy Security Programs Office

Acronym	Definition
ESTCP	Environmental Security Technology Certification Program
EUL	Enhanced Use Lease
FAR	Federal Acquisition Regulation
FEC	Navy Facility Engineering Command
FEMP	Federal Energy Management Program
FRCS	Facility-Related Control Systems
FY	Fiscal Year
FYDP	Future Years Defense Program
GIS	Geographic Information Systems
GSA	General Services Administration
GSHP	Ground Source Heat Pump
HAC	House Appropriations Committee
HASC	House Armed Services Committee
HEL	High-Efficacy Lighting
HQ	Headquarters
HQDA	Headquarters Department of the Army
HQ USAF	Headquarters U.S. Air Force
HVAC	Heating, Ventilation, and Air Conditioning
IC	Intelligence Community
ICO	Installation Commanding Officer
IE	Installation Energy
IEM	Installation Energy Manager
IEP	Installation Energy Plan
IEWP	Army Installation Energy and Water Plan
IGSA	Intergovernmental Support Agreement
INFADS	Internet Navy Facilities Asset Data Store
IoT	Internet of Things
ISR-MC	Army Installation Status Report – Mission Capacity
IT	Information Technology
JB	Joint Base
JBAB	Joint Base Anacostia Bolling
JCS	Joint Chiefs of Staff
JMAA	Joint Mission Assurance Assessment
kV	Kilovolt, 1 thousand Volts
KSF	Thousand Square Feet
KW	Kilowatt, 1 thousand Watts
KWh	Kilowatt-hours
LED	Light-Emitting Diode
LF	Launch Facility
LFG	Landfill Gas
LHC	Land Holding Command

Acronym	Definition
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MCAGCC	Marine Corps Air Ground Combat Center
MCAS	Marine Corps Air Station
MCICOM	Marine Corps Installations Command
MCICOM G-F	MCICOM, Facilities Director
MCICOM GF-PW	MCICOM, Public Works
MCICOM GF-1	Marine Corps Installations Command, Energy and Facilities Operations Section
MCLB	Marine Corps Logistics Base
MCRD	Marine Corps Recruit Depot
MDA	Missile Defense Agency
MDMS	Meter Data Management System
MILCON	Military Construction
MIT-LL	Massachusetts Institute of Technology – Lincoln Laboratory
MMBtu	Million British Thermal Units
MOSAICS	More Situational Awareness for Industrial Control Systems
MW	Megawatt, 1 million Watts
MWh	Megawatt-Hour, 1 million Watt-hours
NAS	Naval Air Station
NAVFAC	Naval Facilities Engineering Command
NBGTS	Naval Base Guam Telecommunications Site
NDAA	National Defense Authorization Act
NDS	National Defense Strategy
NECPA	National Energy Conservation Policy Act
NGA	National Geospatial-Intelligence Agency
NIST CSF	National Institute of Standards and Technology Cybersecurity Framework
NREL	National Renewable Energy Laboratory
NRO	National Reconnaissance Office
NRTF	Naval Radio Transmitter Facility
NSA	National Security Agency
NSA	Naval Supply Activity
NSB	Naval Submarine Base
NTV	Non-Tactical Vehicle
OASD(Sustainment)	Office of the Assistant Secretary of Defense for Sustainment
ODASD(Energy)	Office of the Deputy Assistant Secretary of Defense for Energy
ODASD(DC&MA)	Office of the Deputy Assistant Secretary of Defense for Defense Continuity and Mission Assurance
OE	Operational Energy
OEA	Air Force Office of Energy Assurance
OEI	Army Office of Energy Initiatives
OMB	Office of Management and Budget
OM&T	Operations, Maintenance, and Testing

Acronym	Definition
OPNAV N46	CNO Shore Installation Management Division
OSD	Office of the Secretary of Defense
OT	Operational Technology
PDU	Power Distribution Unit
PHI	Protected Health Information
PII	Personally Identifiable Information
PLC	Programmable Logic Controller
PPA	Power Purchase Agreement
PPBE	Planning, Programming, Budgeting, and Execution
PV	Photovoltaic
PWD	Public Works Department
PWO	Public Works Officer
PW6	Navy FEC Utilities Management Office
PW8	Navy FEC Energy Management Office
REC	Renewable Energy Credit
REGCOM	Navy Regional Commander
REPM	Navy Regional Energy Program Manager
RMF	Risk Management Framework
RPAD	Real Property Assets Database
SAF/IE	Assistant Secretary of the Air Force (Installations, Environment & Energy)
SAF/IEE	Deputy Assistant Secretary of the Air Force Environment, Safety and Infrastructure
SASC	Senate Armed Services Committee
SCADA	Supervisory Control and Data Acquisition
SIR	Savings to Investment Ratio
SIS	Industrial Safety Systems
SMR	Small Modular Reactor
SoS	System of Systems
SRM	Sustainment, Restoration, and Modernization
TCA	Task Critical Asset
TIM	Technical Interchange Meeting
TO	Task Order
UESC	Utility Energy Service Contract
UFC	Unified Facilities Criteria
UMCS	Utility Monitoring and Control System
UP	Utilities Privatization
UPS	Uninterruptible Power Supply
U.S.	United States
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
USAG	U.S. Army Garrison
U.S.C.	U.S. Code

Acronym	Definition
USC	Utility Service Contract
USCYBERCOM	U.S. Cyber Command
USD(A&S)	Under Secretary of Defense for Acquisition and Sustainment
USMC	U.S. Marine Corps
vSMR	Very Small Modular Reactor
WEEC	World Energy Engineering Congress
WHS	Washington Headquarters Service

Appendix B - Compliance Matrix

	Subsection	Description	FY 2019 AEMRR Chapter / Appendix	Page Number
10 U.S.C. § 2925	(a)	Annual Report Related to Installations Energy Management, Energy Resilience, and Mission Assurance and Readiness.- 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, including progress on energy resilience at military installations according to metrics developed by the Secretary. The Secretary shall ensure that mission operators of critical facilities provide to personnel of military installations any information necessary for the completion of such report. 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, including progress on energy resilience at military installations according to metrics developed by the Secretary.	**3, 5**	**13-36, 43-51**
	(a)(2)	A description of the energy savings, return on investment, and enhancements to installation mission assurance realized by the fulfillment of the goals described in paragraph (1).	**3, 5**	**13-36, 43-51**
	(a)(3)	Details of all utility outages degrading energy resilience at military installations (excluding planned outages for maintenance reasons), whether caused by on- or off-installation disruptions, including the total number of outages and their locations, the duration of each outage, the financial effect of each outage, whether or not the mission was affected, the downtimes (in minutes or hours) the mission can afford based on mission requirements and risk tolerances, the responsible authority managing the utility, and measures taken to mitigate the outage by the responsible authority.	**3**	**14-15**
	(a)(4)	Details of a military installation's total energy requirements and critical energy requirements (including critical energy loads in electric and thermal loads and the associated downtime tolerances for critical energy loads), and the current energy resilience and emergency backup systems servicing critical energy requirements, including, at a minimum- (A) energy resilience and emergency backup system power requirements; (B) the 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.	**3, Appendix P**	**17, 105-125**

	Subsection	Description	FY 2019 AEMRR Chapter / Appendix	Page Number
	(a)(5)	A list of energy resilience projects awarded by the Department of Defense by military department and military installation, whether appropriated or alternative financed for the reporting fiscal year, including project description, award date, the critical energy requirements serviced (including critical energy loads in electric and thermal loads), expected reliability of the project (as indicated in the awarded contract), life cycle costs, savings to investment, fuel type, and the type of appropriation or alternative financing used.	**Appendix N**	**79-98**
	(a)(6)	A list of energy resilience projects planned by the Department of Defense by military department and military installation, whether appropriated or alternative financed for the next two fiscal years, including project description, fuel type, expected award date, and the type of appropriation or alternative financing expected for use.	**Appendix O**	**99-104**
	(a)(7)	At the discretion of the Secretary of Defense, a classified annex, as appropriate.		
10 U.S.C. § 2911	(c)(1)	The Secretary of Defense 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**	**62-63**
	(c)(3)	The Secretary of Defense shall include the energy security and resilience goals of the Department of Defense in the installation energy report submitted under section 2925(a) of this title for fiscal year 2018 and every fiscal year thereafter. In the development of energy security and resilience goals, the Department of Defense shall conform with the definitions of energy security and resilience under this title. The report shall include the amount of critical energy load, together with the level of availability and reliability by fiscal year the Department of Defense deems necessary to achieve energy security and resilience.	**Appendix C**	**62-63**
	(d)(1)	The Secretary of Defense 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**	**62-63**
10 U.S.C. § 2688	(g)(4)	The Secretary of Defense, in consultation with the Secretaries of the military departments, shall include in the installation energy report submitted under section 2925(a) of this title a description of progress in meeting energy resilience metrics for all conveyance contracts entered into pursuant to this section.	**3**	**15-16**
Rpt 116-120: HASC FY 2020 committee report	Page 86	Enhancing Installation Energy Resiliency through Renewable Energy	**Appendix F**	**67**
	Page 87	Medium Power Mobile Transformer Substations	**Appendix G**	**68-70**
Rpt 116-48: SASC FY 2020 committee report	Page 139	Defense Energy Resilience Tools for Project Development	**Appendix H**	**71-73**

	Subsection	Description	FY 2019 AEMRR Chapter / Appendix	Page Number
Rpt 116-63: HAC-M FY 2020 committee report	Page 18	Investment in Renewable Energy Systems	**Appendix I**	**74**
	Page 19	Energy Conservation	**Appendix J**	**75**
Conference Report Accompanying the FY 2020 NDAA	Page 1191	Study on Energy Savings Performance Contracts	**Appendix K**	**76**
P.L. 116-92: FY 2020 NDAA	Sec. 2864	Black Start Exercises at Military Installations	**Appendix L**	**77**

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 AEMRR. 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) to:

- Maximize Efficient Energy Use,
- Expand Supply for Mission Assurance, and
- 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 first Master Plan with input from DoD Components. 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 NDS released in February 2018. The Department's energy performance goals and Master Plan will be updated and reported annually in the AEMRR. 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 updates of the Master Plan within the AEMRR.

Energy Performance Goals

The DoD energy goals in Tables C-1 and C-2 are set forth by 42 U.S.C. § 15852(a) and 10 U.S.C. § 2911(g). These goals focus on renewable energy use. Although energy efficiency is no longer a top priority, the Department remains committed to maximizing the efficient use of energy to free up resources for higher priorities. 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 this writing, there are no discreet statutory goals related to energy resilience. Such goals have been requested, and once established, DoD will add these goals into this Energy Performance Master Plan submission. Title 10, U.S.C., section 2911(c)(3) requires DoD to include installation energy security and resilience goals in this report and subsequent AEMRRs. ODASD(Energy) and DoD Components will continue to collaborate and explore what a feasible annual energy resilience goal would be.

Table C-1: DoD Energy Performance Goals

Goal	Description	Uniform Measure	Method of Measurement	Metric
Consume More Electric Energy From Renewable Sources 42 U.S.C. § 15852(a)	Increase consumption of renewable energy	Installation renewable energy consumption	Total renewable electricity consumption as a percentage of total facility electricity consumption.	MWH
Produce Or Procure More Energy From Renewable Sources 10 U.S.C. § 2911(g)	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 total facility electricity consumption.	MWH

Table C-2: Energy Performance Targets

Target	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY25
Consume More Renewable Energy	+5%	+5%	+7.5%	+7.5%	+7.5%	+7.5%	+7.5%	+7.5%	+7.5%	+7.5%	+7.5%
Produce/Procure More Renewable Energy [1]	-	-	-	-	-	-	-	+15%	-	-	+25%
[1]FY 2018 interim target required by 10 U.S.C. § 2911(g)(2)											

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

Renewable Electric Energy Requirement per 42 U.S.C. 15852(a)	Renewable Electricity Use (MWH)	Total Electricity Use (MWH)	Percentage of Facility Electric Use	EPAct 2005 Requirement
Eligible renewable electricity use as a percentage of total electricity use	1,786,626.7	29,751,113.7	6.0%	7.5%

Produce or Procure More Energy From Renewable Sources per 10 U.S.C. 2911(g)	Renewable Energy Produced/Procured (MWH)	Total Electricity Use (MWH)	Percentage of Facility Electric Use	Compliance Target by 2025
Total renewable energy (electric & non-electric) produced or procured as a percentage of total facility electricity consumption	4,628,377.0	29,751,113.7	15.6%	25.0%

Metering Goals	Cumulative # of Buildings Metered For Electricity	Cumulative % of Appropriate Buildings Metered for Electricity	Cumulative # of Buildings Metered for Natural Gas	Cumulative % of Appropriate Buildings Metered for Natural Gas	Cumulative # of Buildings Metered for Steam	Cumulative % of Appropriate Buildings Metered for Steam
Standard Meters in FY 2019	29,891	46.9%	8,629	26.8%	1,708	8.6%
Advanced Meters in FY 2019	29,034	45.5%	5,354	16.6%	1,052	5.3%
Total Meters in FY 2019	58,925	92.4%	13,983	43.4%	2,760	13.9%

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)	93.0%	100.0%

Investments in Energy Management

Sources of Investment	Investment Value (Thou. $)	Anticipated Annual Savings (MMBtu)
Direct obligations for facility energy efficiency improvements	$79,723.1	193,202.4
Investment value of ESPC Task/Delivery Orders awarded in fiscal year	$797,571.6	1,457,887.0
Investment value of UESC Task/Delivery Orders awarded in fiscal year	$24,149.3	69,711.0
TOTAL	$901,444.0	1,720,800.4

	Percent
Total Investment as a percentage of total facility energy cost	25.8%
Financed (ESPC/UESC) investment as a percentage of total facility energy costs	23.5%

Total Installation Energy Consumption and Cost		
Energy Type	BBtu	Cost (thou.)
Electricity	99,723.9	2,573,130.3
Fuel Oil	12,274.5	249,819.9
Natural Gas	73,910.9	471,912.3
LPG	1,041.8	16,347.3
Coal	4,988.9	25,411.9
Steam	3,219.4	75,362.4
Other	292.3	4,395.6
Renewable Electric, On-site	2,608.3	25,548.3
Renewable Electric Off-Site	943.7	12,430.2
Renewable, Other, On-Site	1,802.6	6,660.8
Renewable, Off-Site Green Energy Purchases	431.1	12,188.2
TOTAL	201,237.4	3,473,207.2

Appendix E - FY 2020 NDAA Reporting Requirements Summary

Report	Subsection / Paragraph	Title	Description
Rpt 116-120: HASC FY 2020 committee report	Page 86	Enhancing Installation Energy Resiliency through Renewable Energy	"...the committee directs the Secretary of Defense to provide a report to the Senate Committee on Armed Services and the House Committee on Armed Services by February 1, 2020, on the following: (1) the Department's progress towards meeting the 25 percent goal by military service, the feasibility of increasing this goal as a means of enhancing energy resiliency, and the resources that would be required to accomplish a higher goal; (2) the extent the services share best practices in achieving energy resiliency through renewable energy sources; and (3) the Department's plans for achieving 100 percent energy resilience for its critical energy loads and the feasibility of achieving this goal by fiscal year 2030. If 2030 is not attainable, the report shall include a projection for when this goal will be attainable."
	Page 87	Medium Power Mobile Transformer Substations	"...the committee directs the Secretary of Defense to provide a briefing to the House Committee on Armed Services by February 1, 2020, on the ten military installations with the greatest critical energy requirements and their top five installation critical energy vulnerabilities and appropriate mitigation strategies, strategies to ensure resilience, and mature technologies that enhance capabilities."
Rpt 116-48: SASC FY 2020 committee report	Page 139	Defense Energy Resilience Tools for Project Development	"...the committee directs the Secretary of Defense to provide an implementation plan for the MIT–LL life cycle cost analysis tool to ensure the effective adoption of mission-based decision-making and for the successful implementation of energy resilience projects across the Department of Defense. At a minimum, the committee directs that the Department provide the list of military installations that have and will implement the life-cycle cost analysis tool, along with the funding required by fiscal year to implement the tool's adoption and use. This plan shall include the necessary partnerships needed to develop, implement, and integrate the life-cycle cost analysis tool in the most cost-effective manner. The Secretary shall provide this plan to the Senate Armed Services Committee no later than February 1, 2020."
Rpt 116-63: HAC-M FY 2020 committee report	Page 19	Energy Conservation	"The Committee directs the Secretary of Defense to provide a report no later than 90 days after enactment of this Act on DOD's strategy to increase energy conservation efforts and on energy cost savings, improved unit readiness, and opportunities for return on investments of existing and planned projects."
	Page 18	Investment in Renewable Energy Systems	"...the Committee requests a report no later than 180 days after enactment of this Act detailing DOD's plans for further development of renewable energy systems at military installations and a timeline and goals for increased utilization."
Rpt 116-333: Joint Explanatory Statement Accompanying the FY 2020 NDAA	Page 1191	Study on Energy Savings Performance Contracts	"The conferees direct the Secretary of Defense to conduct a study identifying any legislative or regulatory barriers to entering into more ESPCs. The study should include policy proposals for how the Department of Defense could evaluate the cost savings caused by increasing energy resiliency when evaluating whether to enter into ESPCs. The conferees further direct the Secretary to submit a report on the findings of the study the congressional defense committees not later than 180 days after the date of the enactment of this Act."
P.L. 116-92: Fiscal Year 2020 National Defense Authorization Act	Sec. 2864	Black Start Exercises at Military Installations	"Not later than June 1, 2020, the Secretary of Defense shall submit to the congressional defense committees a report that contains a discussion of lessons learned from black start exercises conducted by the Secretary of Defense during the period beginning with the first such exercise and ending on December 31, 2019, including the three most recurring issues identified as a result of such exercises with respect to infrastructure, joint coordination efforts, and security."

Appendix F - Enhancing Installation Energy Resiliency through Renewable Energy Report

"…the committee directs the Secretary of Defense to provide a report to the Senate Committee on Armed Services and the House Committee on Armed Services by February 1, 2020, on the following:

(1) the Department's progress towards meeting the 25 percent goal by military service, the feasibility of increasing this goal as a means of enhancing energy resiliency, and the resources that would be required to accomplish a higher goal;

(2) the extent the services share best practices in achieving energy resiliency through renewable energy sources; and

(3) the Department's plans for achieving 100 percent energy resilience for its critical energy loads and the feasibility of achieving this goal by fiscal year 2030. If 2030 is not attainable, the report shall include a projection for when this goal will be attainable."

The renewable energy goal referenced in this requirement is established by 10 U.S.C. § 2911(g). The goal states "it shall be the goal of the Department of Defense to produce or procure not less than 25 percent of the total quantity of facility energy it consumes within its facilities during fiscal year 2025 and each fiscal year thereafter from renewable energy sources." Progress towards achievement of this goal for each military service has been routinely reported in the AEMRR since the goal was established and is available in the "Renewable Energy" section of the AEMRR. The Department does not view an increase to this goal as an effective means of increasing energy resilience on military installations. The DoD is technology-agnostic in its approach toward increasing energy resilience and will pursue whichever option is most viable based on life-cycle cost effectiveness and reducing unserved critical load.

The services routinely share best practices on improving installation energy resilience with one another. These best practices include sharing experience with integrating renewable energy into an installation's supply mix and lessons learned. ODASD(Energy) facilitates a periodic installation energy resilience working group that fosters collaboration among services and provides each service an opportunity to discuss their installation energy resilience program with the other services.

The Department interprets "achieving 100 percent energy resilience for its critical energy loads" as the ability to always meet the mission availability requirements of critical facilities over the course of a year. Mission availability requirements and downtime tolerances vary across critical missions. Therefore, rather than expecting all critical missions to experience zero downtime over the course of a year, it is more reasonable to expect a range of values. More information on mission availability and downtime tolerances is available in the "Energy Resilience Metrics and Standards Memorandum." The DoD will continue to execute its IEP process as well as black start exercises to ensure gaps in critical energy requirements are addressed. The Department views the stated goal as ambitious, but potentially achievable if investments and resources align to it.

Appendix G - Medium Power Mobile Transformer Substations Report

"The committee is aware of the Department of Defense's continuing interest in grid resiliency as it pertains to military installations. The committee is interested in understanding and determining the military installations with the greatest critical energy requirements and exhibiting the most significant energy resilience vulnerabilities. Therefore, the committee directs the Secretary of Defense to provide a briefing to the House Committee on Armed Services by February 1, 2020, on the ten military installations with the greatest critical energy requirements and their top five installation critical energy vulnerabilities and appropriate mitigation strategies, strategies to ensure resilience, and mature technologies that enhance capabilities."

The top ten installations reported 750 MW for their peak critical electric power requirements in FY 2019. The Department has undertaken multiple initiatives to identify the energy resilience vulnerabilities at military installations across the DoD, including the top ten installations with the highest peak electric power requirements.

In 2013 and 2014, the Department conducted a power resilience review that examined installation adherence to key energy resilience policies, identified gaps in policy, and engaged the DoD Components to define future energy resilience requirements. The analysis was conducted on all continental United States (CONUS) military installations, inclusive of over two gigawatts (GW) of critical electric power requirement. Of the installations assessed during this power resilience review, some of the vulnerabilities discovered include the following:

- Initial sizing of energy generation was identified as a gap in policy compliance
- O&M in terms of trained operators, preventive maintenance, and fueling plans needed to be better defined in policy
- Exercising and testing backup generation assets and fueling plans was identified as a gap in policy compliance

In 2015 and 2016, the Department continued to work on more detailed energy resilience assessments to review vulnerabilities and conducted specific site visits which included critical military installations. With support from MIT-LL, the DoD conducted 14 specific site assessments to determine energy resilience vulnerabilities and developed the ERA Tool for selecting the energy resilience technologies that can remediate them. Energy resilience assessments were conducted on the following military installations during this effort:

- Naval Base Kitsap Bangor
- Naval Base Kitsap Keyport
- Beale Air Force Base
- Fort Irwin
- Camp Pendleton
- Naval Base San Diego
- Naval Base Coronado
- Naval Base Point Loma
- Naval Support Activity Andersen

- Naval Base Guam
- Marine Corps Base Guam
- Joint Base Pearl Harbor-Hickam
- Naval Air Station Sigonella
- Naval Radio Transmitter Facility (NRTF) Niscemi
- Camp Lejeune
- Naval Station Norfolk
- Joint Base Andrews
- Naval Support Activity Philadelphia
- Philadelphia Navy Yard Annex
- Creech Air Force Base
- Fort Stewart
- Dobbins Air Reserve Base
- Barnes Air National Guard Base

Findings from these energy resilience vulnerability assessments include:

- Communication between installation energy personnel and mission operators could be improved to ensure interdependent mission requirements are met during energy outages
- Improvements in technical capabilities, personnel, and training are needed to better understand energy and cyber resilient systems
- Standardized processes for improvements in OM&T of energy resilient systems are needed
- Life-cycle cost analysis (LCCA) data was not always tracked to help make budget justifications and inform business case decisions
- Performance data aligned to mission requirements (e.g. energy availability, outages, failure rates) were not always tracked to help make tradeoff decisions between cost and mission requirements

The Department determined that a lack of testing and exercising was a major vulnerability that needed to be considered for energy resilience solutions. Since 2016, the Department and MIT-LL have visited five military installations to conduct black start exercises, which included Fort Stewart, Fort Greely, Fort Bragg, Vandenberg Air Force Base, and Hanscom Air Force Base. Some of the energy resilience vulnerabilities uncovered through these exercises include:

- Backup power hardware problems (e.g., component failures, incorrectly configured systems, under-loaded backup generators)
- Issues with emergency communication systems
- Confusion about power restoration sequence between organizations
- Mission reliance on off-installation information and personnel for system repair
- Water and wastewater system monitoring reliant on relays without backup power

The DoD plans to continue conducting these exercises in response to the HASC's congressional requirement at the following three installations:

- Joint Base McGuire-Dix-Lakehurst
- Joint Base Langley-Eustis
- Eielson Air Force Base

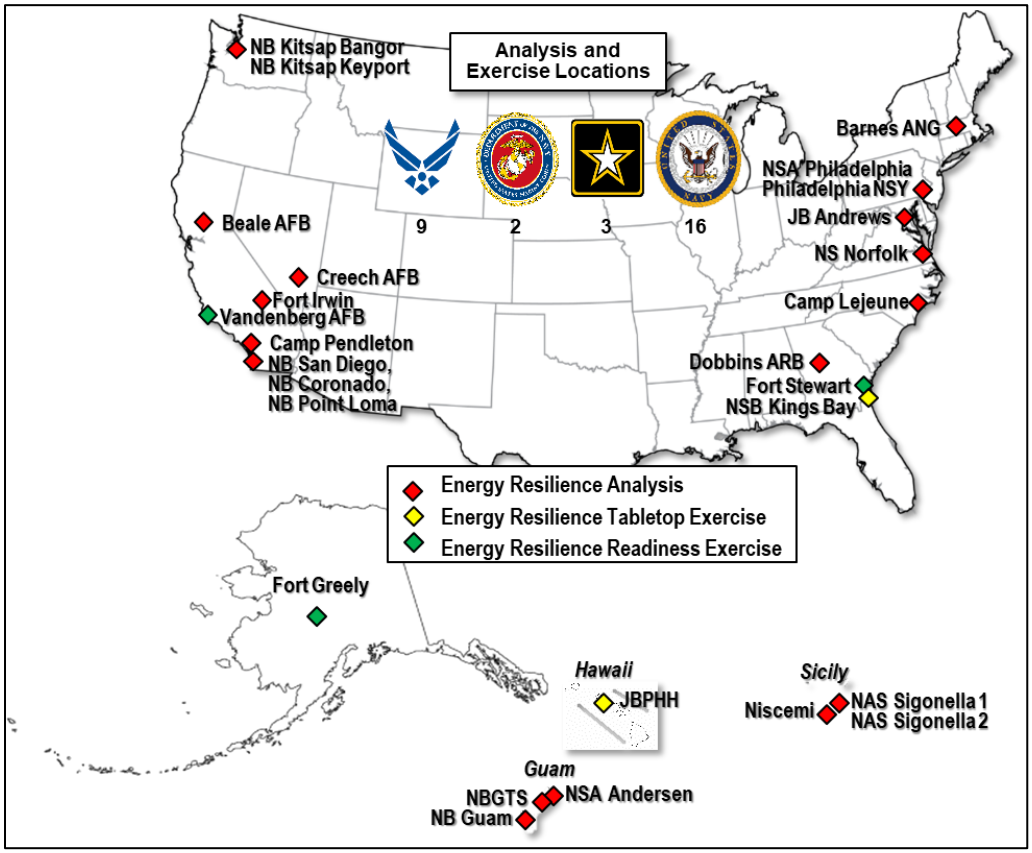
Based on the results from assessments and exercises, appropriate solutions will be identified and funded to the maximum extent possible in order to mitigate the risks associated with these energy resilience vulnerabilities. More information on the above initiatives is available on the OASD(S) website.

Appendix H - Defense Energy Resilience Tools for Project Development Report

"…the committee directs the Secretary of Defense to provide an implementation plan for the MIT–LL life cycle cost analysis tool to ensure the effective adoption of mission-based decision-making and for the successful implementation of energy resilience projects across the Department of Defense. At a minimum, the committee directs that the Department provide the list of military installations that have and will implement the life-cycle cost analysis tool, along with the funding required by fiscal year to implement the tool's adoption and use. This plan shall include the necessary partnerships needed to develop, implement, and integrate the life-cycle cost analysis tool in the most cost-effective manner. The Secretary shall provide this plan to the Senate Armed Services Committee no later than February 1, 2020."

MIT-LL transferred the internally developed ERA Tool to ODASD(Energy) in September 2018. The web-based tool is available to DoD users and DoD installations across all Services may be analyzed. Since the tool became available to the broader DoD community, over 80 users have performed at least one analysis, with many users running ten or more simulations, and nearly 100 users across the DoD have attended training sessions provided by ODASD(Energy).

The Department has conducted 22 tool-based assessments at multiple military installations starting in FY 2015. The following map shows where the tool has been applied based on these assessments.



Further, beginning with FY 2022 submissions, use of the ERA Tool is required by all installations in order to receive ERCIP funding for energy resilience projects. The list below includes installations that have either used the ERA Tool for ERCIP project submissions or locations where the tool has been used as part of an assessment or exercise:

- Fort Benning
- Fort Rucker
- Fort Bragg
- Fort Stewart
- Camp Arifjan
- MTA Camp Shelby
- Camp Grayling
- PR013 – Ramey
- PR010 - Juana Diaz
- MCAS Miramar
- NB Guam
- NAF Atsugi
- NCE Springfield
- Fort Irwin
- Camp Lejeune
- Camp Pendleton
- Barnes ANG
- Beale AFB
- Creech AFB
- Dobbins ARB
- JB Andrews
- JB Pearl Harbor Hickam
- NAS Sigonella 1
- NAS Sigonella 2
- NB Coronado
- NBGTS
- NB Kitsap Banger
- NB Kitsap Keyport
- NB Point Loma
- NB San Diego
- NRTF Niscemi
- NSA Andersen
- NSA Philadelphia
- NS Norfolk
- PNY Annex

Continued adoption of the tool by every DoD installation is paramount to efforts of the Department to ensure energy resilience projects are awarded based on their impact to mission success and alignment with the NDS. This effort will require the following to accomplish:

(1) integrate analysis outputs with the ERCIP submission materials for installation based energy resilience improvement projects;

(2) incorporate additional energy resilience technologies and user feature requests into the analysis platform;

(3) hold ongoing virtual or live training sessions for new users, develop additional training materials for reference while using the tool, and provide technical support for user questions and troubleshooting;

(4) train a core user group from the Services to assist installation energy managers simulate their resilience projects;

(5) transfer software code to DOD entity selected to host the tool and educate that entity on how to maintain, modify, and add elements to the tool; and

(6) establish a collaboration between a subset of existing tools to create a workflow from project concept through implementation.

To implement the tool's adoption and use, approximately one million dollars would be needed in the first year for capital costs and five hundred thousand dollars for sustainment every year thereafter.

OSD recognizes the value provide by the ERA Tool and that as the user base becomes more widespread, interactions between OSD, MIT-LL, and the installation users will be critical in identifying appropriate upgrades that improve the user experience and effectiveness of the analysis. These interactions can occur electronically, through the feature request portal, as well as through on-going training sessions and discussion groups. In addition, the on-going adoption of the tool should include the identification of existing critical infrastructure toolsets and the lessons learned in their adoption, as well as potential partner organizations who may provide development support or complementary toolsets.

Appendix I - Investment in Renewable Energy Systems Report

"The Committee supports the military's continued investment in renewable energy systems, including the use and application of solar energy for mobility and resilience capabilities at defense military installations including military bases, barracks, hospitals, and airfields. Such investments have yielded positive results such as increased resiliency and cost-savings. The Committee encourages DOD to prioritize funding for renewable energy-related projects, including solar, to mitigate risk to mission-critical assets and to promote energy security and efficiency at military installations. Accordingly, the Committee requests a report no later than 180 days after enactment of this Act detailing DOD's plans for further development of renewable energy systems at military installations and a timeline and goals for increased utilization."

Increasing energy resilience on military installations remains a top priority for the Department. To this end, the DoD is technology-agnostic when deciding on solutions that mitigate energy resilience vulnerabilities and fill gaps in critical energy load requirements. More important than the technology type are the life-cycle cost-effectiveness of the system and the amount of critical load served. Renewable energy systems are among many technological options available to the Department and will continue to be implemented when they are the most feasible solution. The DoD will continue to execute its IEP process as well as black start exercises to determine the most appropriate energy resilience solutions for the unique circumstances of each military installation.

The DoD is currently subject to two renewable energy goals: 10 U.S.C. § 2911(g) and Section 203 of the Energy Policy Act (EPAct) 2005 (42 U.S.C. § 15852(a)). More information on these two goals and the Department's progress can be found in the "Renewable Energy" section of the AEMRR. Given these existing goals and the reasons mentioned above, the DoD does not have plans to develop additional goals for increased utilization of renewable energy systems on military installations at this time.

Appendix J - Energy Conservation Report

"The Committee commends DOD's forward posture on the need to improve energy resilience, improve mission assurance, save energy, and reduce energy costs. DOD must continue to increase the integration of alternative energy sources, particularly through renewable sources, throughout military facilities and installations. Energy resilience is critical to mission assurance for military units that perform cyber and intelligence, surveillance, and reconnaissance functions, missions vitally important to America's complex global engagements. The Committee directs the Secretary of Defense to provide a report no later than 90 days after enactment of this Act on DOD's strategy to increase energy conservation efforts and on energy cost savings, improved unit readiness, and opportunities for return on investments of existing and planned projects."

The DoD recognizes energy efficiency as a contributing factor to energy resilience on military installations. The Department reduced its total energy consumption compared to last year and will continue to implement measures that reduce consumption where financially and technologically practicable. However, solutions that address energy resilience vulnerabilities and mitigate risk to mission readiness will be prioritized over those that provide increased energy efficiency. The shift in the Department's focus from energy efficiency to energy resilience is reflected in numerous updates to policy and guidance that have been issues over the last several years.

While historic investments in energy efficiency projects continue to provide energy cost savings, not all planned energy resilience projects will result in cost savings. For example, configuring a microgrid that can island itself from the commercial grid, adding battery storage to on-site generation assets, and creating redundant electrical feeds to eliminate single points of failure improve mission readiness and provide energy resilience in the event of a utility disruption, but do not necessarily provide energy cost savings. The Department will continue to use its appropriated funds (e.g. ERCIP) and alternative financing authorities (e.g. ESPCs and UESCs) to seek projects that bundle both energy efficiency measures and energy resilience measures. Implementing these bundled projects are ideal because they lead to more efficient operations and improve national security.

Appendix K - Study on Energy Savings Performance Contracts Report

"The conferees direct the Secretary of Defense to conduct a study identifying any legislative or regulatory barriers to entering into more ESPCs. The study should include policy proposals for how the Department of Defense could evaluate the cost savings caused by increasing energy resiliency when evaluating whether to enter into ESPCs. The conferees further direct the Secretary to submit a report on the findings of the study the congressional defense committees not later than 180 days after the date of the enactment of this Act."

The Department is authorized to enter into ESPCs under 42 U.S.C. § 8287 and does not recognize any legislative or regulatory barriers to entering into more ESPCs at this time. ESPCs enable the Department to cost-effectively pursue energy resilience solutions in a holistic and integrated fashion through the use of third-party financing. In FY 2019, the DoD awarded 14 task/delivery orders at an investment value of over $797 million. In 2018, the Department issued the "Policy on Energy Savings Performance Contracts and Utility Energy Service Contracts" to provide updated guidance on the use of ESPCs and UESCs to enhance energy resilience and cybersecurity at DoD installations in support of the National Defense Strategy (NDS). Details of this policy can be found on the OASD(S) website.[14] Cost savings caused by increasing energy resilience generally come from more energy efficient technology and reduced time and labor on equipment maintenance. The Department will continue to implement projects that both reduce operating costs and increase energy resilience on military installations.

[14] https://www.acq.osd.mil/eie/IE/FEP_Policy_Program_Guidance.html

Appendix L - Black Start Exercises at Military Installations Report

"(b) REPORT.—Not later than June 1, 2020, the Secretary of Defense shall submit to the congressional defense committees a report that contains a discussion of lessons learned from black start exercises conducted by the Secretary of Defense during the period beginning with the first such exercise and ending on December 31, 2019, including the three most recurring issues identified as a result of such exercises with respect to infrastructure, joint coordination efforts, and security."

The black start exercises completed by OSD provided invaluable lessons learned that fall within three key areas. First, OSD learned that unknown interdependences exist between the energy systems and other systems on military installations, such as communications and life, health, and safety systems. Second, full operational testing and exercises ensure that all critical building loads (e.g., elevators, emergency signs and lights, doors, etc.) are on the backup system when power is disrupted. Third, military installations lack the appropriate resourcing strategy for interior electrical systems contributing to energy resilience, such as purchases, testing, and maintenance of transfer switches and UPS.

Overall, the black start exercises conducted thus far have provided critical information to prioritize energy resilience gaps to remediate risks and vulnerabilities that would prevent mission degradation or failure. The DoD is addressing these gaps through its IEP process with priority focus on the most cost-effective solutions that provide the maximum benefit to improve energy resilience and mission readiness.

Appendix M - OM&T Costs for Energy Resilience Systems by Service

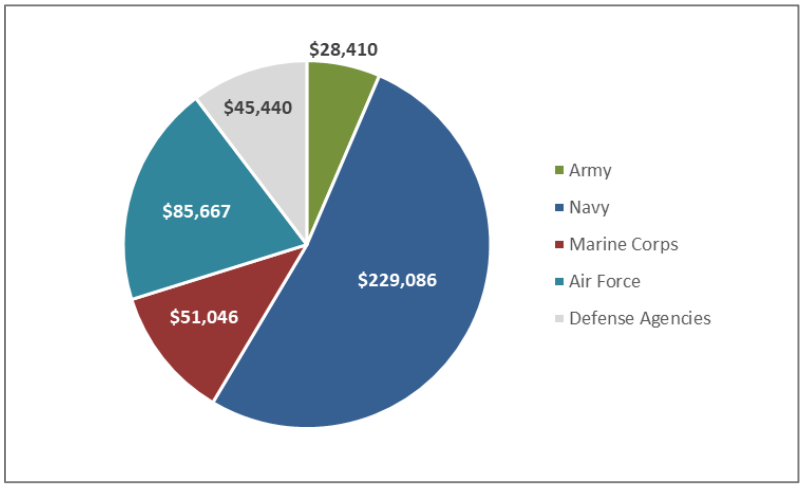


Figure 9: OM&T Costs for Energy Resilience Systems[15]

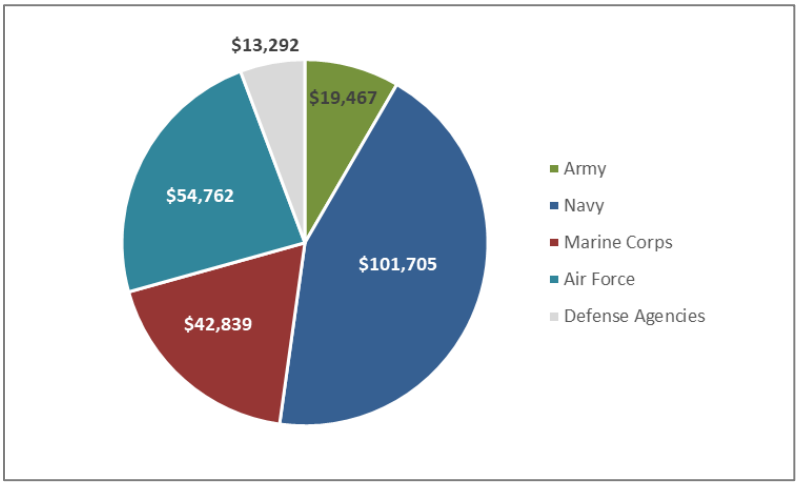


Figure 10: Funded OM&T Remediation Costs for Energy Resilience Systems

[15] FY 2019 is the first year of reporting this data. The Department will leverage lessons learned and will work to improve data collection procedures in the future.

Appendix N - Energy Resilience Projects Awarded in FY 2019

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Project Name	Fiscal Year of Award	Project Description	Fuel Type
ARMY	ARARNG	Appropriated	MILCON	PEC Liberty & Patriot Hall Generators	2019	Reliability and redundancy improvements – generators added	Electricity
ARMY	Caserma Del Din	Appropriated	ERCIP	Upgrade Central Energy Plant (CEP)	2019	Reliability improvements – service and maintenance of existing power generation	Electricity
ARMY	Caserma Ederle	Appropriated	ERCIP	Ederle CHP and Add Thermal Storage	2019	Reliability and redundancy improvements – on-site generation added	Natural Gas
ARMY	Chievres Air Base	Appropriated	ERCIP	Convert Heating and Lighting Systems	2019	Other resilience improvements	Natural Gas
ARMY	Germersheim Army Depot	Appropriated	SRM	Separate Drinking Water System Germersheim	2019	Other resilience improvements	Other
ARMY	USAG Ansbach	Appropriated	Other	Standby Generator Bldg 5513	2019	Reliability and redundancy improvements – generators added	Fuel Oil
ARMY	USAG Bavaria Hohenfels	Appropriated	SRM	Replace failing high voltage, water, sewer system between mount 1 and 3	2019	Power quality improvements	Electricity
ARMY	USAG Bavaria Hohenfels	Appropriated	SRM	Replace failing high voltage cables phase VIII, rev III	2019	Power quality improvements	Electricity

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Project Name	Fiscal Year of Award	Project Description	Fuel Type
ARMY	USAG Bavaria Hohenfels	Appropriated	SRM	Repair transformer station B-89	2019	Reliability improvements – service and maintenance of existing power generation	Electricity
ARMY	USAG Bavaria Hohenfels	Appropriated	SRM	Repair leaking district heating lines at various camps	2019	Other resilience improvements	Purchased Steam
ARMY	USAG Bavaria Hohenfels	Appropriated	ERCIP	Install 1, 5 MW Photovoltaic System	2019	Reliability and redundancy improvements – on-site generation added	Renewable
ARMY	USAG Bavaria Hohenfels	Appropriated	O&M	Install Energy Resilience Microgrid incl. emergency power generator, CHP & solar PV hook up Bldg# H535	2019	Reliability and redundancy improvements – on-site generation added	Renewable
ARMY	USAG Bavaria TB - Grafenwoehr	Appropriated	SRM	Replace 20 kV line from Rg 305 to Rg 307	2019	Power quality improvements	Electricity
ARMY	USAG Bavaria TB - Grafenwoehr	Appropriated	SRM	Replace overhead line by underground cable	2019	Power quality improvements	Electricity
ARMY	USAG Bavaria TB - Grafenwoehr	Appropriated	SRM	Replace defective 20kV Protection relays in the Net Protection Stations	2019	Power quality improvements	Electricity
ARMY	USAG Bavaria TB - Grafenwoehr	Appropriated	SRM	Upgrade utility infrastructure at Camp Kasserine for RAF	2019	Reliability improvements – service and maintenance of existing power generation	Electricity
ARMY	USAG Stuttgart Patch Barracks	Appropriated	Other	Energy Conservation	2019	Energy Efficiency Upgrades ; Optimize Server/Telecom Rooms Cooling Units	Electricity

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Project Name	Fiscal Year of Award	Project Description	Fuel Type
ARMY	USAG Stuttgart Patch Barracks	Appropriated	Other	Energy Efficiency Upgrades ; Optimize Server/Telecom Rooms Cooling Units	2019	Other resilience improvements	Electricity
ARMY	USAG Wiesbaden	Appropriated	SRM	Install Solar PV system at Access Control Point	2019	Reliability and redundancy improvements – on-site generation added	Renewable
ARMY	USAG Wiesbaden	Appropriated	SRM	Install Solar PV system at #1030 (Post Office)	2019	Reliability and redundancy improvements – on-site generation added	Renewable
ARMY	USAG Humphreys	Appropriated	SRM	Camp Humphreys Solar and CHP	2019	Reliability and redundancy improvements – on-site generation added	Natural Gas
ARMY	63rd Readiness Division (Mountain View ARC)	Appropriated	SRM	LED Retrofit	2019	Other resilience improvements	Electricity
ARMY	CAARNG	Appropriated	SRM	Camp Roberts Fire Dept. Backup Generator	2019	Reliability and redundancy improvements – generators added	Natural Gas
ARMY	Parks RFTA	Appropriated	SRM	Repair Electrical Infrastructure, Electrical Substations (15 Nodes) and Microgrid	2019	Other resilience improvements	Electricity
ARMY	Sierra Army Depot	Appropriated	UESC	UESC - SIAD	2019	Other resilience improvements	Electricity
ARMY	CTARNG	Appropriated	SRM	AASF Generator Replacement	2019	Reliability and redundancy improvements – generators added	Fuel Oil

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Project Name	Fiscal Year of Award	Project Description	Fuel Type
ARMY	CTARNG	Appropriated	SRM	Enfield Generator	2019	Reliability and redundancy improvements – generators added	Natural Gas
ARMY	CTARNG	Appropriated	SRM	Hartell Generator Installation P123 Design	2019	Reliability and redundancy improvements – generators added	Natural Gas
ARMY	CTARNG	Appropriated	SRM	New Haven Generator Installation Design	2019	Reliability and redundancy improvements – generators added	Natural Gas
ARMY	DEARNG	Appropriated	SRM	Generator	2019	Reliability and redundancy improvements – generators added	Natural Gas
ARMY	DEARNG	Appropriated	SRM	BBTS utility infrastructure project	2019	Power quality improvements	Renewable
ARMY	DEARNG	Appropriated	SRM	Beau Biden RC Microgrid project	2019	Reliability and redundancy improvements – on-site generation added	Renewable
ARMY	DEARNG	Appropriated	SRM	RC Solar Array PV Expansion	2019	Reliability and redundancy improvements – on-site generation added	Renewable
ARMY	FLARNG	Appropriated	SRM	CBJTC Bldg 2300 Generator Installation	2019	Reliability and redundancy improvements – generators added	Fuel Oil
ARMY	FLARNG	Appropriated	SRM	Homestead RC Generator Installation	2019	Reliability and redundancy improvements – generators added	Fuel Oil

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Project Name	Fiscal Year of Award	Project Description	Fuel Type
ARMY	FLARNG	Appropriated	SRM	Tallahassee RC Generator	2019	Reliability and redundancy improvements – generators added	Fuel Oil
ARMY	CNGC	Appropriated	SRM	Overhead to Underground Utilities	2019	Reliability improvements – service and maintenance of existing power generation	Electricity
ARMY	Fort Benning	Appropriated	Other	Additional Generation for Micro-Grid Phase 2	2019	Reliability and redundancy improvements – generators added	Natural Gas
ARMY	USAG-HI	Appropriated	UP	Initial System Deficiency Correction (ISDC) Projects and Other Improvements	2019	Other resilience improvements	Other
ARMY	USAG-HI Schofield Barracks and Wheeler Army Airfield	Alternative Financed	Other	Install Relays at Castner, Menoher, and Wheeler Army Airfield substations	2019	Other resilience improvements	Electricity
ARMY	Rock Island Arsenal	Appropriated	SRM	Raw Water Line	2019	Other resilience improvements	Other
ARMY	IAARNG	Appropriated	Other	Modernize Electrical Infrastructure Phase 1A1	2019	Other resilience improvements	Other
ARMY	IAARNG	Appropriated	Other	Modernize Electrical Infrastructure Phase 1A2	2019	Other resilience improvements	Other
ARMY	Fort Riley	Appropriated	SRM	B77694 Generator	2019	Reliability and redundancy improvements – on-site generation added	Natural Gas

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Project Name	Fiscal Year of Award	Project Description	Fuel Type
ARMY	KSARNG	Appropriated	SRM	Leavenworth 1951 Generator (Designed)	2019	Reliability and redundancy improvements – generators added	Other
ARMY	KSARNG	Appropriated	SRM	Manhattan RC Generator	2019	Reliability and redundancy improvements – generators added	Other
ARMY	KSARNG	Appropriated	SRM	Hutchinson RC & FMS Generator	2019	Reliability and redundancy improvements – generators added	Other
ARMY	KSARNG	Appropriated	SRM	Forbes AFRC 688 Generator	2019	Reliability and redundancy improvements – generators added	Other
ARMY	KSARNG	Appropriated	SRM	Topeka RC Basement (Designed) DDC	2019	Other resilience improvements	Electricity
ARMY	KSARNG	Appropriated	SRM	Forbes AFRC 688 Power Factor Correction - 75%	2019	Power quality improvements	Electricity
ARMY	KSARNG	Appropriated	SRM	Wichita North FMS DDC + Power Factor Correction - 83%	2019	Power quality improvements	Electricity
ARMY	KSARNG	Appropriated	SRM	Salina 558 Power Factor Correction - 75%	2019	Power quality improvements	Electricity
ARMY	KSARNG	Appropriated	SRM	Salina 556 & 560 Power Factor Correction - 78%	2019	Power quality improvements	Electricity

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Project Name	Fiscal Year of Award	Project Description	Fuel Type
ARMY	KSARNG	Appropriated	SRM	Kansas City RC Power Factor Correction - 73%	2019	Power quality improvements	Electricity
ARMY	KSARNG	Appropriated	SRM	Salina GPTC 217 Power Factor Correction - 65%	2019	Power quality improvements	Electricity
ARMY	KSARNG	Appropriated	SRM	Forbes 2005 Power Factor Correction - 84%	2019	Power quality improvements	Electricity
ARMY	KYARNG	Appropriated	SRM	BNGC Electrical Upgrade	2019	Reliability improvements – service and maintenance of existing power generation	Electricity
ARMY	MNARNG	Appropriated	SRM	East Substation Generator	2019	Reliability and redundancy improvements – generators added	Fuel Oil
ARMY	Fort Leonard Wood	Appropriated	ERCIP	2.5 MW CHP - Bldg 2369	2019	Reliability and redundancy improvements – on-site generation added	Natural Gas
ARMY	Fort Leonard Wood	Appropriated	Other	Water Connection with Community	2019	Other resilience improvements	Other
ARMY	Fort Leonard Wood	Appropriated	UP	UP - Water System	2019	Other resilience improvements	Other
ARMY	Fort Leonard Wood	Appropriated	UP	UP - Waste Water System	2019	Other resilience improvements	Other

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Project Name	Fiscal Year of Award	Project Description	Fuel Type
ARMY	MTARNG	Appropriated	SRM	AASF Backup Generator	2019	Reliability and redundancy improvements – generators added	Other
ARMY	NYARNG	Appropriated	SRM	Camp Smith	2019	Install 600 kW Generator	Fuel Oil
ARMY	NYARNG	Appropriated	SRM	Latham Generator	2019	Install 750 kW Generator	Natural gas
ARMY	Camp Gruber Training Center	Appropriated	SRM	CGTC Electric Upgrades NW Extension	2019	Other resilience improvements	Electricity
ARMY	Camp Gruber Training Center	Appropriated	SRM	CGTC HVAC Life Cycle Replacement	2019	Power quality improvements	Electricity
ARMY	Camp Gruber Training Center	Appropriated	SRM	CGTC Sewer Line Type B	2019	Other resilience improvements	Other
ARMY	Camp Gruber Training Center	Appropriated	SRM	CGTC Post HQ Generator	2019	Reliability and redundancy improvements – generators added	Propane
ARMY	Camp Gruber Training Center	Appropriated	SRM	CGTC Water Plant Generator	2019	Reliability and redundancy improvements – generators added	Propane
ARMY	Joint Force Headquarters	Appropriated	SRM	JFHQ Civil Type B	2019	Other resilience improvements	Other

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Project Name	Fiscal Year of Award	Project Description	Fuel Type
ARMY	Lexington AASF	Appropriated	SRM	Lexington AASF Elect Repairs Type A and B	2019	Power quality improvements	Electricity
ARMY	Lexington AASF	Appropriated	SRM	Lexington AASF LE200 Elect Repairs Type A and B	2019	Power quality improvements	Electricity
ARMY	Lexington AASF	Appropriated	SRM	Electrical Upgrade LE300	2019	Power quality improvements	Electricity
ARMY	OKARNG	Appropriated	SRM	EMCS BCS Upgrades	2019	Power quality improvements	Other
ARMY	West OKC AFRC	Appropriated	SRM	West OKC Boiler Replacement	2019	Other resilience improvements	Natural Gas
ARMY	ORANG	Appropriated	SRM	CUO Water Distribution Repair Phase II	2019	Other resilience improvements	Other
ARMY	ORANG	Appropriated	SRM	Salem AASF Solar Array	2019	Reliability and redundancy improvements – on-site generation added	Renewable
ARMY	ORANG	Appropriated	SRM	Anderson Readiness Center Solar Array PV	2019	Reliability and redundancy improvements – on-site generation added	Renewable
ARMY	Fort Indian Towns Gap	Appropriated	ERCIP	Lines, Water Distribution, Potable	2019	Other resilience improvements	Other

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Project Name	Fiscal Year of Award	Project Description	Fuel Type
ARMY	81st Readiness Division (Ceiba ARC)	Appropriated	ERCIP	Install 650 kW PV Solar Array	2019	Reliability and redundancy improvements – on-site generation added	Renewable
ARMY	Fort Jackson	Appropriated	ERCIP	Install Combined Heat and Power Systems	2019	Reliability and redundancy improvements – generators added	Natural Gas
ARMY	TNARNG	Appropriated	SRM	Nashville JFHQ Mott Bldg Lighting Replacement	2019	Other resilience improvements	Electricity
ARMY	TNARNG	Appropriated	SRM	UTES FTCKY Lighting Repairs	2019	Other resilience improvements	Electricity
ARMY	TNARNG	Appropriated	SRM	Nashville FMS 9 Lighting Repairs	2019	Other resilience improvements	Electricity
ARMY	TNARNG	Appropriated	SRM	Columbia FMS Lighting Repairs	2019	Other resilience improvements	Electricity
ARMY	TNARNG	Appropriated	SRM	Trenton FMS Lighting Repairs	2019	Other resilience improvements	Electricity
ARMY	TNARNG	Appropriated	SRM	VTS Smyrna 425 Emergency Generator	2019	Reliability and redundancy improvements – generators added	Fuel Oil
ARMY	TNARNG	Appropriated	SRM	Louisville AASF Emergency Generator	2019	Reliability and redundancy improvements – on-site generation added	Fuel Oil

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Project Name	Fiscal Year of Award	Project Description	Fuel Type
ARMY	Camp Williams	Appropriated	ERCIP	Microgrid/Wind Turbine	2019	Reliability and redundancy improvements – generators added	Natural Gas
ARMY	Fort Belvoir	Appropriated	SRM	Replace Electrical Feeds, HVAC, Generators at Earth Terminal Complex	2019	Reliability and redundancy improvements – on-site generation added	Electricity
ARMY	Fort Belvoir	Appropriated	SRM	Upgrade Standby Generator at Fire Dept.	2019	Reliability improvements – service and maintenance of existing power generation	Fuel Oil
ARMY	Fort Lee	Appropriated	UP	Fort Lee Post Main Substation and Transmission Line Tap	2019	Other resilience improvements	Electricity
DLA	San Joaquin	Appropriated	WCF	Replace existing Solar PV	2019	Reliability improvements – service and maintenance of existing power generation	Renewable
DLA	Susquehanna	Appropriated	WCF	High voltage equipment maintenance	2019	Other resilience improvements	Electricity
DLA	Susquehanna	Appropriated	WCF	Replace utility poles	2019	Other resilience improvements	Electricity
DLA	Susquehanna	Appropriated	WCF	Generator maintenance	2019	Reliability improvements – service and maintenance of existing power generation	Fuel Oil
DLA	Richmond	Appropriated	WCF	Development of Energy Resiliency Study	2019	Reliability improvements – service and maintenance of existing power generation	Electricity

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Project Name	Fiscal Year of Award	Project Description	Fuel Type
MDA	Fort Greely	Appropriated	MILCON	SIV power redundancy	2019	Other resilience improvements	Electricity
MDA	Fort Greely	Appropriated	MILCON	Redundant/diverse MF feeders	2019	Other resilience improvements	Electricity
NAVY	NS Rota	Appropriated	WCF	Replace HV Distribution Crossarms and Insulators	2019	Other resilience improvements	Electricity
NAVY	NS Rota	Appropriated	WCF	Feeder 4 HV Distribution Repairs	2019	Other resilience improvements	Electricity
NAVY	NS Rota	Appropriated	MILCON	Ship to Shore Electrical Substations at Pier #1	2019	Other resilience improvements	Electricity
NAVY	NS Rota	Appropriated	WCF	Centralize Utility Control Systems	2019	Other resilience improvements	Other
NAVY	NS Rota	Appropriated	ESPC	Photovoltaic System Installation	2019	Reliability and redundancy improvements – on-site generation added	Renewable
NAVY	NSA Lago Patria	Appropriated	WCF	Replace two MV Switchgears at Bldgs. 119 & 120	2019	Other resilience improvements	Electricity
NAVY	NSA Naples Capo	Appropriated	WCF	Electrical substations upgrade at BLDG 440 (C4I)	2019	Other resilience improvements	Electricity

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Project Name	Fiscal Year of Award	Project Description	Fuel Type
NAVY	NSA Naples Capo	Appropriated	WCF	Replace underground water distribution system, Capodichino (1st step)	2019	Other resilience improvements	Other
NAVY	NSA Naples Capo	Appropriated	WCF	Replace underground water distribution system, Capodichino (2nd step)	2019	Other resilience improvements	Other
NAVY	NSF Diego Garcia	Appropriated	ERCIP	Energy - Install Up to 3MW Solar Photovoltaic Array	2019	Other resilience improvements	Renewable
NAVY	NAWS China Lake	Alternative Financed	WCF	Repair by Replacement Michelson Lab Substation	2019	Power quality improvements	Electricity
NAVY	NAWS China Lake	Alternative Financed	WCF	Emergency Sky Top Substation and Circuit 5 Repair	2019	Power quality improvements	Electricity
NAVY	NAWS China Lake	Appropriated	Other	Install Electrical SCADA System at Various Substations	2019	Power quality improvements	Electricity
NAVY	PMRF Barking Sands	Appropriated	O&M	Upgrade Power Plant Bldg 711 PMRF Hawaii	2019	Reliability improvements – service and maintenance of existing power generation	Electricity
NAVY	NAS Oceana VA	Appropriated	WCF	REPLACE 34.5KV ELECTRICAL GAS SWITCHES	2019	Other resilience improvements	Electricity
NAVY	NAVSUPPACT Norfolk NSY	Appropriated	WCF	Replace Unit Substation D2, Bldg 31	2019	Other resilience improvements	Electricity

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Project Name	Fiscal Year of Award	Project Description	Fuel Type
NAVY	NAVSUPPACT Norfolk NSY	Appropriated	WCF	Bldg 60 Replace Loop Cable F4/F-15 (Replace 15KV Electrical Cables, Controlled Industrial Area)	2019	Other resilience improvements	Electricity
NAVY	NSY Portsmouth	Appropriated	WCF	Repair MG#1 and DC Switchboards at Substation 3	2019	Other resilience improvements	Electricity
NAVY	NSY Portsmouth	Appropriated	WCF	Replace Ungrounded and Grounded Shore Power Boxes	2019	Other resilience improvements	Electricity
NAVY	NAVBASE Kitsap Bremerton WA	Appropriated	Local	Replace Transformers at B-5061, 5065, 5066	2019	Other resilience improvements	Electricity
NAVY	NAVBASE Kitsap Bremerton WA	Appropriated	Local	Bldg. 7719 Heat Pump Controls upgrades	2019	Other resilience improvements	Other
NAVY	NAVBASE Kitsap Bremerton WA	Appropriated	Local	Bldg. 1058 Boiler System Upgrade	2019	Other resilience improvements	Other
NAVY	NAVBASE Kitsap Bremerton WA	Appropriated	Local	Keyport Extend Gas Line and Convert 5090 Series to Gas from Oil and Propane	2019	Other resilience improvements	Propane
NAVY	NAVBASE Kitsap Bremerton WA	Appropriated	Local	JACE upgrades base-wide	2019	Other resilience improvements	Other
NAVY	NAVBASE Kitsap Bremerton WA	Appropriated	Local	Reroof B-489 and add R-22 insulation	2019	Other resilience improvements	Other

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Project Name	Fiscal Year of Award	Project Description	Fuel Type
NAVY	NAVBASE Kitsap Bremerton WA	Appropriated	Local	B-84 Reroof East Section and Window Repair	2019	Other resilience improvements	Other
NAVY	NAVBASE Kitsap Bremerton WA	Appropriated	Local	Bldg. 825 reroofing with insulation	2019	Other resilience improvements	Other
NAVY	NAVBASE Kitsap Bremerton WA	Alternative Financed	UESC	Energy Efficiency Measures in Various Buildings	2019	Other resilience improvements	Electricity
NAVY	NAVBASE Kitsap Bremerton WA	Appropriated	Local	Bldg. 84, 38, 233 Destratification Fans	2019	Other resilience improvements	Electricity
NAVY	NAVBASE Kitsap Bremerton WA	Alternative Financed	UESC	Implementation of EISA Audits - Various Bldgs.	2019	Other resilience improvements	Other
NSA	NSA	Appropriated	ERCIP	Renewable Energy System Installations and Facilities Energy Improvements - Oahu	2019	Other resilience improvements	Renewable
USAF	JB Elmendorf - Richardson	Appropriated	ERCIP	HVAC Phase 09	2019	Other resilience improvements	Natural Gas
USAF	JB Elmendorf - Richardson	Appropriated	ERCIP	HVAC Bldg 9549	2019	Other resilience improvements	Natural Gas
USAF	JB Elmendorf - Richardson	Appropriated	ERCIP	Boiler Upgrade, Seq D	2019	Other resilience improvements	Natural Gas

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Project Name	Fiscal Year of Award	Project Description	Fuel Type
USAF	JB Elmendorf - Richardson	Appropriated	ERCIP	Boiler Upgrade, Seq E	2019	Other resilience improvements	Natural Gas
USAF	Davis-Monthan AFB	Appropriated	SRM	Repair/Construction Primary Electric Distribution for Energy Resiliency	2019	Reliability and redundancy improvements – generators added	Electricity
USAF	Little Rock AFB	Appropriated	MILCON	Base-wide External Lighting	2019	Other resilience improvements	Electricity
USAF	RAF Lakenheath	Appropriated	SRM	Repair Lighting LED (72)	2019	Other resilience improvements	Electricity
USAF	RAF Lakenheath	Appropriated	SRM	Repair Lighting LED Communications Facility (1100)	2019	Other resilience improvements	Electricity
USAF	Misawa AB	Appropriated	MILCON	Repair Boiler, Boiler Plant B1337	2019	Other resilience improvements	Natural Gas
USAF	Osan AB	Appropriated	ERCIP	Phase 1 of Natural Gas Conversion from Heating Fuel	2019	Other resilience improvements	Natural Gas
USAF	Schriever Air Force Base	Appropriated	ERCIP	Upgrade Chillers Seq DX Controls and Cooling Towers	2019	Other resilience improvements	Electricity
USAF	Eglin AFB	Alternative Financed	ESPC	Energy Assurance, peak shaving	2019	Reliability and redundancy improvements – generators added	Natural Gas

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Project Name	Fiscal Year of Award	Project Description	Fuel Type
USAF	Hurlburt Field	Appropriated	SRM	Repair Capacitor Bank, Electrical Substation, Bldg 90590	2019	Power quality improvements	Electricity
USAF	Tyndall AFB	Appropriated	SRM	Convert Overhead Lines to Underground, Base-wide, Phase 1	2019	Other resilience improvements	Electricity
USAF	JB Andrews	Appropriated	SRM	Repair Fire Roof Electrical HVAC 89 MXG HGR 7 FAC 1279	2019	Reliability improvements – service and maintenance of existing power generation	Electricity
USAF	JB Andrews	Appropriated	SRM	Repair Fire Roof Electrical HVAC 89 MXG HGR 7 FAC 1280	2019	Reliability improvements – service and maintenance of existing power generation	Electricity
USAF	JB Andrews	Appropriated	SRM	Replace Switchgear, BLDG 1279	2019	Reliability improvements – service and maintenance of existing power generation	Electricity
USAF	Cannon AFB	Appropriated	MILCON	Portales Gate	2019	Power quality improvements	Electricity
USAF	Cannon AFB	Appropriated	MILCON	DLA Fuels	2019	Reliability and redundancy improvements – generators added	Fuel Oil
USAF	Cannon AFB	Appropriated	O&M	Replace generator	2019	Reliability improvements – service and maintenance of existing power generation	Fuel Oil
USAF	Cannon AFB	Appropriated	O&M	Replace generator	2019	Reliability improvements – service and maintenance of existing power generation	Fuel Oil

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Project Name	Fiscal Year of Award	Project Description	Fuel Type
USAF	Cannon AFB	Appropriated	O&M	Replace generator	2019	Reliability improvements – service and maintenance of existing power generation	Fuel Oil
USAF	Kirtland AFB , NM	Alternative Financed	Other	Solar powered direct current micro grid with battery backup	2019	Reliability and redundancy improvements – on-site generation added	Renewable
USAF	Grand Forks Air Force Base	Appropriated	SRM	Repair (SUS) Generator Network Control Center B242	2019	Reliability and redundancy improvements – generators added	Fuel Oil
USAF	Wright-Patterson AFB	Appropriated	UP	Repair Substation E	2019	Other resilience improvements	Electricity
USAF	Wright-Patterson AFB	Appropriated	UP	Repair Substation C	2019	Other resilience improvements	Electricity
USAF	Wright-Patterson AFB	Appropriated	UP	Replace Switch, F/30206	2019	Other resilience improvements	Electricity
USAF	Wright-Patterson AFB	Appropriated	UP	Replace Service, F/20435	2019	Other resilience improvements	Electricity
USAF	Wright-Patterson AFB	Appropriated	UP	Replace Switch and Transformer, F/20654	2019	Other resilience improvements	Electricity
USAF	Wright-Patterson AFB	Appropriated	UP	Replace Switch, F/20676	2019	Other resilience improvements	Electricity

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Project Name	Fiscal Year of Award	Project Description	Fuel Type
USAF	Wright-Patterson AFB	Appropriated	UP	Replace Switch, F/20837	2019	Other resilience improvements	Electricity
USAF	Wright-Patterson AFB	Appropriated	UP	Replaced Switch, F/21615	2019	Other resilience improvements	Electricity
USAF	Wright-Patterson AFB	Appropriated	UP	Repair Cable Fault, WD-1211	2019	Other resilience improvements	Electricity
USAF	JB Charleston	Appropriated	O&M	Repair OH Electric Area K	2019	Reliability improvements – service and maintenance of existing power generation	Electricity
USAF	Shaw Air Force Base	Appropriated	O&M	Repair Power Distribution Polifka	2019	Power quality improvements	Electricity
USAF	Incirlik Air Base Adana	Appropriated	O&M	Repair/Replace MV Cable Between Bldgs. 3610 & 400	2019	Other resilience improvements	Electricity
USAF	Incirlik Air Base Adana	Appropriated	O&M	Repair/Replace Transformer, Facility 5515 (TR53)	2019	Other resilience improvements	Electricity
USAF	Incirlik Air Base Adana	Appropriated	O&M	Repair/Replace MV Cable Between 3610, TR40, TR41, FAC 5027	2019	Other resilience improvements	Electricity
USAF	Incirlik Air Base Adana	Appropriated	O&M	CNS/Upgrade Capacitor Bank, FAC 3610	2019	Power quality improvements	Electricity

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Project Name	Fiscal Year of Award	Project Description	Fuel Type
USAF	Hill Air Force Base	Appropriated	UP	MV Switchgear Improvements	2019	Reliability improvements – service and maintenance of existing power generation	Electricity
USAF	Hill Air Force Base	Appropriated	O&M	B238 Steam Line Replacement	2019	Other resilience improvements	Natural Gas
USMC	MCAS Miramar	Appropriated	Other	Building 6311 - Energy Storage Battery	2019	Other resilience improvements	Electricity
USMC	MCAS Miramar	Appropriated	Other	Installation Microgrid Energy Storage and Base-wide HVAC Demand Response	2019	Other resilience improvements	Electricity
USMC	MCB Hawaii	Appropriated	ERCIP	District CHW and HW Plant	2019	Other resilience improvements	Other
USMC	MCB Camp Lejeune	Alternative Financed	UESC	MCB Camp Lejeune TO1-TO3	2019	Other resilience improvements	Other

Appendix O - Energy Resilience Planned Projects

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Planned Award Date	Project Description	Fuel Type
ARMY	Fort Benning	Appropriated	ERCIP	09/30/2023	Construct a 48 MW Generation Plant and Microgrid Controls	Other
ARMY	Fort Hood	Appropriated	ERCIP	09/30/2023	Install a Central Energy Plant	Other
ARMY	Fort Huachuca	Appropriated	ERCIP	09/30/2023	Install Microgrid Control System and Battery Energy Storage System	Other
ARMY	Fort Indiantown Gap AGS	Appropriated	ERCIP	09/30/2022	Install 150 Ton Geothermal 400kW Solar PV Array Install Cogen System Central Plant	Other
ARMY	Fort Jackson	Appropriated	ERCIP	09/30/2022	Install Combined Heat and Power Systems	Other
ARMY	Fort Leonard Wood	Appropriated	ERCIP	09/30/2022	Install Cogen System Central Plant	Other
ARMY	Fort Rucker	Appropriated	ERCIP	09/30/2023	Construct a 10MW Generation Plant and Microgrid Controls	Other
ARMY	Point Nuevo	Appropriated	ERCIP	09/30/2022	Install Microgrid, 550kW Solar PV, 750KWH Battery, 750 kW Diesel Generator	Other
ARMY	US Army Garrison Hohenfels	Appropriated	ERCIP	09/30/2022	Install 1.5MW Solar Photovoltaic	Other
ARMY	White Sands Missile Range	Appropriated	ERCIP	09/30/2023	Install Microgrid, 700kW Solar Photovoltaic Array, 150kW Gas Generator, and Batteries	Other
Defense Agency	Unspecified Installation	Appropriated	FSRM	02/01/2020	Other resilience improvements	Electricity
Defense Agency	Unspecified Installation	Appropriated	WCF	02/01/2020	Other resilience improvements	Electricity

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Planned Award Date	Project Description	Fuel Type
Defense Agency	Unspecified Installation	Appropriated	WCF	09/29/2020	Reliability and redundancy improvement - add backup generators	Other
Defense Agency	Unspecified Installation	Appropriated	WCF	09/30/2020	Install Solar PV	Renewables
Defense Agency	Unspecified Installation	Appropriated	WCF	09/30/2021	Generator for refrigerated warehouse storage units	Electricity
Defense Agency	Unspecified Installation	Appropriated	WCF	09/30/2020	Portable Generators	Electricity
Defense Agency	Unspecified Installation	Appropriated	WCF	09/30/2020	Electrical Improvements Bldgs. 9 & 306	Electricity
Defense Agency	Unspecified Installation	Appropriated	WCF	09/30/2021	PV Installation Pilot Microgrid	Electricity
Defense Agency	Unspecified Installation	Appropriated	WCF	09/30/2019	Energy Resilience Assessment	Electricity
Defense Agency	Unspecified Installation	Appropriated	WCF	09/29/2021	Energy Resilience Table Top Exercises	Electricity
Defense Agency	Unspecified Installation	Appropriated	WCF	09/30/2021	Operations, Maintenance and Testing	Electricity
Defense Agency	Unspecified Installation	Appropriated	WCF	09/30/2020	Installation Energy Management Plan	Other
Defense Agency	Unspecified Installation	Appropriated	WCF	09/30/2020	ISO 50001	Other
Defense Agency	Unspecified Installation	Appropriated	FSRM	01/30/2020	Other Resilience improvements Repair/Replace UPS units 1A,2A,3A	Other
Defense Agency	Unspecified Installation	Appropriated	FSRM	06/30/2020	Other Resilience improvements Repair/Replace UPS units 1B, 2B, 3B	Other

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Planned Award Date	Project Description	Fuel Type
Defense Agency	Unspecified Installation	Appropriated	FSRM	06/30/2020	Power Quality Improvements Repair/Replace Primary Distribution (Companion to Ameren new feed)	Other
Defense Agency	Unspecified Installation	Appropriated	FSRM	04/30/2020	Other Resilience improvements Upgrade 12.47 kV electric serviced to reliable service/provide redundant feed	Other
Defense Agency	Unspecified Installation	Appropriated	FSRM	07/25/2021	Other Resilience improvements Repair/Replace UPS Units B1 & B2	Other
Defense Agency	Unspecified Installation	Appropriated	FSRM	07/25/2021	Other Resilience improvements Repair/Replace UPS Units A1 & A2	Other
Defense Agency	Unspecified Installation	Appropriated	FSRM	07/25/2021	Other Resilience improvements Repair/Replace UPS units 1B,2B,3B	Other
Defense Agency	Unspecified Installation	Appropriated	FSRM	06/15/2021	Other Resilience improvements Replace UPS Batteries Group A	Other
Defense Agency	Unspecified Installation	Appropriated	FSRM	07/25/2021	Other Resilience improvements Repair/Replace UPS Units C and D	Other
Defense Agency	Unspecified Installation	Appropriated	FSRM	06/15/2021	Other Resilience improvements Campus Wide UPS inverter Replacement	Other
Defense Agency	Unspecified Installation	Appropriated	FSRM	06/15/2021	Other Resilience improvements Install UPS Bypass for the VCC/TECH/CUP/PG and TCP's	Other
Defense Agency	Unspecified Installation	Appropriated	FSRM	06/15/2021	Reliability improvements-service and maintenance of existing power generation Generator 10-12 Retrofit	Other
Defense Agency	Unspecified Installation	Appropriated	FSRM	06/15/2021	Other Resilience improvements Additional Power Monitoring (low voltage panels) EPMS	Other
Defense Agency	Unspecified Installation	Appropriated	FSRM	09/30/2020	Other resilience improvements	Other
NAVY	NAS JRB New Orleans LA	Appropriated	ERCIP	09/30/2020	Electrical Distribution System	Electricity

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Planned Award Date	Project Description	Fuel Type
NAVY	Naval Base Kitsap Bremerton WA	Appropriated	ERCIP	09/30/2021	Keyport Main Substation Replacement	Electricity
NAVY	Naval Station Newport RI	Alternative Financed	EUL	09/03/2020	NAVSTA Newport Model 2 EUL	Other
NAVY	Naval Weapons Station Earle NJ	Alternative Financed	EUL	09/03/2020	NWS Earle Model 2 EUL	Other
NAVY	NAVBASE GUAM	Appropriated	ERCIP	09/30/2020	Automated Controls at 74 Facilities, Various Locations	Other
NAVY	NAVBASE GUAM	Appropriated	ERCIP	09/30/2021	NSA Andersen Smart Grid and ICS	Other
NAVY	NAVBASE Ventura County Point Mugu CA	Appropriated	ERCIP	09/30/2020	SNI Energy Storage System	Other
NAVY	NAVSUPPACT Bahrain	Appropriated	MILCON	09/01/2020	Other resilience improvements	Other
NAVY	NAVSUPPACT Bethesda MD	Appropriated	ERCIP	09/30/2021	Chiller 3-9 Replacement	Electricity
NAVY	NAVSUPPACT Souda Bay GR	Appropriated	ERCIP	09/30/2020	Energy Management Control Systems (EMCS)	Other
NAVY	NAVSUPPDET Monterey CA	Appropriated	ERCIP	09/30/2021	Cogeneration Plant at B236	Electricity
NAVY	NAWS China Lake	Appropriated	ERCIP	09/30/2021	Solar Energy Storage System	Renewables
USAF	Bangor IAP	Appropriated	ERCIP	10/01/2022	Install 300 kW Solar PV System and Battery Storage	Renewables
USAF	Beale AF BASE	Appropriated	ERCIP	09/30/2020	230/60kV Interconnection and Transmission System (BAEY253000)	Electricity

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Planned Award Date	Project Description	Fuel Type
USAF	Buckley AFB	Appropriated	ERCIP	10/01/2021	Construct Hardened Secondary Distribution Microgrid System (JMAX199070)	Fuel Oil
USAF	Channel Islands ANG Station	Appropriated	ERCIP	10/01/2022	Phase II Construct Resiliency System	Electricity
USAF	FT Smith MAP	Appropriated	ERCIP	10/01/2022	Install 776 KW solar PV System and battery storage	Renewables
USAF	GEN Mitchell IAP (ANGB)	Appropriated	ERCIP	10/01/2022	Construct Base-wide Microgrid with Battery Storage	Electricity
USAF	McGhee Tyson Airport	Appropriated	ERCIP	11/01/2020	Construct Ground Base PV Array (PSXE172003)	Renewables
USAF	McGuire AFB	Alternative Financed	EUL	09/30/2021	Reliability and redundancy Improvements	Natural Gas
USAF	McGuire AFB	Alternative Financed	PPA	06/01/2020	Reliability and redundancy Improvements	Electricity
USAF	McGuire AFB	Alternative Financed	EUL	09/30/2021	Reliability and redundancy Improvements	Electricity
USAF	Memphis IAP	Appropriated	ERCIP	10/01/2022	Install 1.8 MW Solar PV System and Battery Storage	Renewables
USAF	MT Home AFB	Appropriated	ERCIP	10/01/2021	Construct Water Treatment Plant and Pump Station (QYZH1072111)	Other
USAF	Nellis AFB	Appropriated	ERCIP	10/01/2022	Creech Central Standby Generators (LKTC223104)	Fuel Oil
USAF	Pease ANGB New Hampshire	Appropriated	ERCIP	10/01/2022	Construct 300KW PV Plant With Integral BESS For Squadron OPS	Renewables
USAF	Robins Air Force Base	Appropriated	ERCIP	10/01/2022	Liquefied Natural Gas (LNG) Plant	Propane

Component	Installation Name	Funding Source Category	Funding Source Sub-Category	Planned Award Date	Project Description	Fuel Type
USAF	Springfield Beckley	Appropriated	ERCIP	10/01/2022	Install 1.4 MW Solar PV and Battery Storage	Renewables
USAF	Wright-Patterson AFB	Appropriated	ERCIP	03/01/2021	Repair Steam & HTHW Line D (partial) Area A with N.G. Boilers (ZHTV120044)	Natural Gas
USAF	Wright-Patterson AFB	Appropriated	ERCIP	10/01/2021	Construct Intelligence Facility Central Utility Plant (ZHTV193001)	Other

Appendix P - Energy Consumption by Installation

Component	Command	State / Country	Installation Name	Gross Square Footage (Thou. SF)	Total Site Delivered Energy (BBtu)
AIR FORCE	ACC	ARIZONA	DAVIS-MONTHAN AIR FORCE BASE	5,262	260
AIR FORCE	ACC	CALIFORNIA	BEALE AIR FORCE BASE	3,282	470
AIR FORCE	ACC	FLORIDA	TYNDALL AIR FORCE BASE	3,874	208
AIR FORCE	ACC	GEORGIA	MOODY AIR FORCE BASE	3,222	220
AIR FORCE	ACC	IDAHO	MOUNTAIN HOME AIR FORCE BASE	2,941	328
AIR FORCE	ACC	NEBRASKA	OFFUTT AIR FORCE BASE	7,107	884
AIR FORCE	ACC	NEVADA	NELLIS AIR FORCE BASE	9,958	888
AIR FORCE	ACC	NEW MEXICO	HOLLOMAN AIR FORCE BASE	5,961	523
AIR FORCE	ACC	NORTH CAROLINA	SEYMOUR JOHNSON AIR FORCE BASE	3,291	266
AIR FORCE	ACC	NORTH DAKOTA	GRAND FORKS AIR FORCE BASE	2,729	337
AIR FORCE	ACC	SOUTH CAROLINA	SHAW AIR FORCE BASE	3,302	330
AIR FORCE	ACC	VIRGINIA	LANGLEY AIR FORCE BASE	10,035	1,266
AIR FORCE	AETC	ALABAMA	MAXWELL AIR FORCE BASE	6,065	647
AIR FORCE	AETC	ARIZONA	LUKE AIR FORCE BASE	4,103	287
AIR FORCE	AETC	MISSISSIPPI	COLUMBUS AIR FORCE BASE	1,569	147
AIR FORCE	AETC	MISSISSIPPI	KEESLER AIR FORCE BASE	6,460	423
AIR FORCE	AETC	OKLAHOMA	ALTUS AIR FORCE BASE	2,522	300
AIR FORCE	AETC	OKLAHOMA	VANCE AIR FORCE BASE	1,468	142
AIR FORCE	AETC	TEXAS	GOODFELLOW AIR FORCE BASE	2,553	230
AIR FORCE	AETC	TEXAS	JOINT BASE SAN ANTONIO	35,583	2,940
AIR FORCE	AETC	TEXAS	LAUGHLIN AIR FORCE BASE	1,847	121
AIR FORCE	AETC	TEXAS	SHEPPARD AIR FORCE BASE	7,074	672
AIR FORCE	AFDW	MARYLAND	JOINT BASE ANDREWS-NAVAL AIR FACILITY WASHINGTON	5,505	519
AIR FORCE	AFGSC	LOUISIANA	BARKSDALE AIR FORCE BASE	5,058	417
AIR FORCE	AFGSC	MISSOURI	WHITEMAN AIR FORCE BASE	3,782	532
AIR FORCE	AFGSC	MONTANA	MALMSTROM AIR FORCE BASE	3,187	560
AIR FORCE	AFGSC	NEW MEXICO	KIRTLAND AIR FORCE BASE	7,819	860
AIR FORCE	AFGSC	NORTH DAKOTA	MINOT AIR FORCE BASE	4,326	601
AIR FORCE	AFGSC	SOUTH DAKOTA	ELLSWORTH AIR FORCE BASE	4,044	497
AIR FORCE	AFGSC	TEXAS	DYESS AIR FORCE BASE	3,443	287

Component	Command	State / Country	Installation Name	Gross Square Footage (Thou. SF)	Total Site Delivered Energy (BBtu)
AIR FORCE	AFGSC	WYOMING	FRANCIS E WARREN AIR FORCE BASE	3,160	355
AIR FORCE	AFMC	CALIFORNIA	EDWARDS AIR FORCE BASE	9,063	789
AIR FORCE	AFMC	FLORIDA	EGLIN AIR FORCE BASE	11,699	1,202
AIR FORCE	AFMC	GEORGIA	ROBINS AIR FORCE BASE	13,449	1,937
AIR FORCE	AFMC	MASSACHUSETTS	HANSCOM AIR FORCE BASE	2,475	475
AIR FORCE	AFMC	OHIO	WRIGHT PATTERSON AIR FORCE BASE	16,673	2,995
AIR FORCE	AFMC	OKLAHOMA	TINKER AIR FORCE BASE	18,867	2,560
AIR FORCE	AFMC	TENNESSEE	ARNOLD AIR STATION	3,139	1,680
AIR FORCE	AFMC	UTAH	HILL AIR FORCE BASE	13,492	2,617
AIR FORCE	AFRC	CALIFORNIA	MARCH AIR RESERVE BASE	2,355	135
AIR FORCE	AFRC	FLORIDA	HOMESTEAD AIR RESERVE BASE	1,156	60
AIR FORCE	AFRC	GEORGIA	DOBBINS AIR RESERVE BASE	1,094	99
AIR FORCE	AFRC	INDIANA	GRISSOM AIR RESERVE BASE	1,080	90
AIR FORCE	AFRC	MASSACHUSETTS	WESTOVER AIR RESERVE BASE	1,695	174
AIR FORCE	AFRC	MINNESOTA	MINNEAPOLIS-ST PAUL IAP-AIR RESERVE STN	710	73
AIR FORCE	AFRC	NEW YORK	NIAGARA FALLS IAP-AIR RESERVE STATION	755	86
AIR FORCE	AFRC	OHIO	YOUNGSTOWN-WARREN REGIONAL AIRPORT ARS	821	80
AIR FORCE	AFRC	PENNSYLVANIA	PITTSBURGH IAP-AIR RESERVE STN	569	47
AIR FORCE	AFSOC	FLORIDA	HURLBURT FIELD	4,850	542
AIR FORCE	AFSOC	NEW MEXICO	CANNON AIR FORCE BASE	3,355	372
AIR FORCE	AFSPC	CALIFORNIA	LOS ANGELES AIR FORCE BASE	1,109	84
AIR FORCE	AFSPC	CALIFORNIA	VANDENBERG AIR FORCE BASE	5,092	664
AIR FORCE	AFSPC	COLORADO	BUCKLEY AIR FORCE BASE	1,684	385
AIR FORCE	AFSPC	COLORADO	PETERSON AIR FORCE BASE	6,803	1,827
AIR FORCE	AFSPC	COLORADO	SCHRIEVER AIR FORCE BASE	2,291	431
AIR FORCE	AFSPC	FLORIDA	PATRICK AIR FORCE BASE	6,765	743
AIR FORCE	AMC	ARKANSAS	LITTLE ROCK AIR FORCE BASE	3,506	436
AIR FORCE	AMC	CALIFORNIA	TRAVIS AIR FORCE BASE	6,471	468
AIR FORCE	AMC	DELAWARE	DOVER AIR FORCE BASE	3,814	457
AIR FORCE	AMC	FLORIDA	MACDILL AIR FORCE BASE	5,343	540
AIR FORCE	AMC	ILLINOIS	SCOTT AIR FORCE BASE	4,828	596

Component	Command	State / Country	Installation Name	Gross Square Footage (Thou. SF)	Total Site Delivered Energy (BBtu)
AIR FORCE	AMC	KANSAS	MCCONNELL AIR FORCE BASE	2,802	299
AIR FORCE	AMC	NEW JERSEY	MCGUIRE AIR FORCE BASE	13,608	1,066
AIR FORCE	AMC	SOUTH CAROLINA	CHARLESTON AIR FORCE BASE	8,679	775
AIR FORCE	AMC	WASHINGTON	FAIRCHILD AIR FORCE BASE	4,011	413
AIR FORCE	ANG	ALABAMA	BIRMINGHAM INTERNATIONAL AIRPORT	372	25
AIR FORCE	ANG	ALABAMA	MONTGOMERY REGIONAL AIRPORT (ANG) BASE	537	35
AIR FORCE	ANG	ALASKA	EIELSON AIR FORCE BASE	288	24
AIR FORCE	ANG	ALASKA	JOINT BASE ELMENDORF-FT RICHARDSON	712	68
AIR FORCE	ANG	ARIZONA	SKY HARBOR INTERNATIONAL AIRPORT	276	18
AIR FORCE	ANG	ARIZONA	TUCSON INTERNATIONAL AIRPORT	691	45
AIR FORCE	ANG	ARKANSAS	FORT SMITH MUNICIPAL AIRPORT ANG	414	24
AIR FORCE	ANG	ARKANSAS	LITTLE ROCK AIR FORCE BASE	315	31
AIR FORCE	ANG	CALIFORNIA	CHANNEL ISLANDS ANG STATION	345	15
AIR FORCE	ANG	CALIFORNIA	FRESNO YOSEMITE INTERNATIONAL	454	23
AIR FORCE	ANG	CALIFORNIA	MARCH AIR RESERVE BASE	308	66
AIR FORCE	ANG	CALIFORNIA	MOFFETT FLD ANG	441	12
AIR FORCE	ANG	COLORADO	BUCKLEY AIR FORCE BASE	588	37
AIR FORCE	ANG	CONNECTICUT	BRADLEY INTERNATIONAL AIRPORT (ANG)	447	46
AIR FORCE	ANG	DELAWARE	NEW CASTLE COUNTY AIRPORT	339	29
AIR FORCE	ANG	FLORIDA	CAMP BLANDING MILITARY RESERVATION (ANG)	124	4
AIR FORCE	ANG	FLORIDA	JACKSONVILLE IAP ANG	400	24
AIR FORCE	ANG	GEORGIA	ROBINS AIR FORCE BASE	989	81
AIR FORCE	ANG	GEORGIA	SAVANNAH/HILTON HEAD INTERNATIONAL AP	913	47
AIR FORCE	ANG	GUAM	ANDERSEN AIR FORCE BASE	52	3
AIR FORCE	ANG	HAWAII	HICKAM AIR FORCE BASE	852	33
AIR FORCE	ANG	IDAHO	BOISE AIR TERMINAL (ANG)	566	29
AIR FORCE	ANG	ILLINOIS	ABRAHAM LINCOLN CAPITAL AIRPORT	332	24
AIR FORCE	ANG	ILLINOIS	GENERAL WAYNE A. DOWNING PEORIA INTERNATIONAL AIRPORT (ANG)	448	35
AIR FORCE	ANG	ILLINOIS	SCOTT AIR FORCE BASE	354	32
AIR FORCE	ANG	INDIANA	FORT WAYNE INTERNATIONAL AIRPORT	443	40

Component	Command	State / Country	Installation Name	Gross Square Footage (Thou. SF)	Total Site Delivered Energy (BBtu)
AIR FORCE	ANG	INDIANA	HULMAN REGIONAL AIRPORT	393	32
AIR FORCE	ANG	IOWA	DES MOINES INTERNATIONAL AIRPORT ANG	417	38
AIR FORCE	ANG	IOWA	SIOUX GATEWAY AP/COL. BUD DAY FIELD (ANG)	477	46
AIR FORCE	ANG	KANSAS	FORBES FIELD ANG	487	44
AIR FORCE	ANG	KANSAS	MCCONNELL AIR FORCE BASE	503	67
AIR FORCE	ANG	KENTUCKY	LOUISVILLE INTERNATIONAL AIRPORT - STANDIFORD FIELD	417	25
AIR FORCE	ANG	LOUISIANA	NEW ORLEANS NAS ANG	507	39
AIR FORCE	ANG	MAINE	BANGOR INTERNATIONAL AIRPORT (ANG)	512	55
AIR FORCE	ANG	MARYLAND	AIR NATIONAL GUARD READINESS CENTER (ANG)	348	90
AIR FORCE	ANG	MARYLAND	JOINT BASE ANDREWS-NAVAL AIR FACILITY WASHINGTON	498	60
AIR FORCE	ANG	MARYLAND	MARTIN STATE AIRPORT ANG	442	30
AIR FORCE	ANG	MASSACHUSETTS	BARNES MUNICIPAL AIRPORT ANG	513	42
AIR FORCE	ANG	MASSACHUSETTS	OTIS AIR NATIONAL GUARD BASE	736	49
AIR FORCE	ANG	MICHIGAN	ALPENA COUNTY REGIONAL AIRPORT	566	50
AIR FORCE	ANG	MICHIGAN	SELFRIDGE ANG BASE	1,640	177
AIR FORCE	ANG	MICHIGAN	W K KELLOGG AIRPORT	406	50
AIR FORCE	ANG	MINNESOTA	DULUTH INTERNATIONAL AIRPORT (ANG)	466	64
AIR FORCE	ANG	MINNESOTA	MINNEAPOLIS-ST PAUL IAP-AIR RESERVE STN	467	40
AIR FORCE	ANG	MISSISSIPPI	GULFPORT-BILOXI REGIONAL AIRPORT (ANG)	634	28
AIR FORCE	ANG	MISSISSIPPI	JACKSON INTERNATIONAL AIRPORT	538	86
AIR FORCE	ANG	MISSISSIPPI	KEY FIELD AIR NATIONAL GUARD	409	28
AIR FORCE	ANG	MISSOURI	JEFFERSON BARRACKS ANG STATION	213	15
AIR FORCE	ANG	MISSOURI	LAMBERT ST LOUIS IAP ANG	45	4
AIR FORCE	ANG	MISSOURI	ROSECRANS MEMORIAL AIRPORT	394	26
AIR FORCE	ANG	MONTANA	GREAT FALLS IAP ANG	391	33
AIR FORCE	ANG	NEBRASKA	LINCOLN MUNICIPAL AIRPORT (ANG)	362	36
AIR FORCE	ANG	NEVADA	RENO TAHOE INTERNATIONAL AIRPORT	403	28
AIR FORCE	ANG	NEW HAMPSHIRE	PEASE INTERNATIONAL TRADEPORT	538	55
AIR FORCE	ANG	NEW JERSEY	ATLANTIC CITY INTERNATIONAL AIRPORT	491	39
AIR FORCE	ANG	NEW JERSEY	MCGUIRE AIR FORCE BASE	436	43
AIR FORCE	ANG	NEW MEXICO	KIRTLAND AIR FORCE BASE	314	19

Component	Command	State / Country	Installation Name	Gross Square Footage (Thou. SF)	Total Site Delivered Energy (BBtu)
AIR FORCE	ANG	NEW YORK	FRANCIS S GABRESKI AIRPORT (ANG)	360	38
AIR FORCE	ANG	NEW YORK	NIAGARA FALLS IAP-AIR RESERVE STATION	181	17
AIR FORCE	ANG	NEW YORK	SCHENECTADY COUNTY AIRPORT ANG	426	40
AIR FORCE	ANG	NEW YORK	STEWART INTERNATIONAL AIRPORT	868	95
AIR FORCE	ANG	NEW YORK	SYRACUSE HANCOCK FIELD ANG	499	47
AIR FORCE	ANG	NORTH CAROLINA	CHARLOTTE/DOUGLAS INT AIRPORT (ANG)	599	25
AIR FORCE	ANG	NORTH DAKOTA	HECTOR INTERNATIONAL AIRPORT (ANG)	492	40
AIR FORCE	ANG	OHIO	CAMP PERRY ANG STATION	182	7
AIR FORCE	ANG	OHIO	MANSFIELD LAHM AIRPORT ANG	547	52
AIR FORCE	ANG	OHIO	RICKENBACKER INTERNATION AIRPORT (ANG)	509	43
AIR FORCE	ANG	OHIO	SPRINGFIELD BECKLEY MUNICIPAL AIRPORT	504	44
AIR FORCE	ANG	OHIO	TOLEDO EXPRESS AIRPORT ANG	389	38
AIR FORCE	ANG	OKLAHOMA	TULSA INTERNATIONAL AIRPORT	384	40
AIR FORCE	ANG	OKLAHOMA	WILL ROGERS WORLD AIRPORT	403	30
AIR FORCE	ANG	OREGON	KLAMATH FALLS AIRPORT-KINGSLEY FIELD	500	41
AIR FORCE	ANG	OREGON	PORTLAND INTERNATIONAL AIRPORT	790	58
AIR FORCE	ANG	PENNSYLVANIA	FT INDIANTOWN GAP ANG STATION	348	19
AIR FORCE	ANG	PENNSYLVANIA	HARRISBURG IAP	330	26
AIR FORCE	ANG	PENNSYLVANIA	PITTSBURGH INTERNATIONAL AIRPORT (ANG)	450	56
AIR FORCE	ANG	PENNSYLVANIA	WILLOW GROVE AIR RESERVE STATION	517	39
AIR FORCE	ANG	PUERTO RICO	LUIS MUNOZ MARIN INTERNATIONAL AIRPORT	475	26
AIR FORCE	ANG	RHODE ISLAND	QUONSET STATE AIRPORT ANG	410	46
AIR FORCE	ANG	SOUTH CAROLINA	MCENTIRE JOINT NATIONAL GUARD BASE	451	34
AIR FORCE	ANG	SOUTH DAKOTA	JOE FOSS FIELD ANG	439	46
AIR FORCE	ANG	TENNESSEE	MCGHEE TYSON AIRPORT	881	83
AIR FORCE	ANG	TENNESSEE	MEMPHIS INTERNATIONAL AIRPORT	626	72
AIR FORCE	ANG	TENNESSEE	NASHVILLE INTERNATIONAL AIRPORT	230	20
AIR FORCE	ANG	TEXAS	CARSWELL AIR RESERVE STATION	360	14
AIR FORCE	ANG	TEXAS	ELLINGTON FIELD	493	41
AIR FORCE	ANG	TEXAS	KELLY FIELD ANNEX (LACKLAND AFB)	388	30
AIR FORCE	ANG	UTAH	SALT LAKE CITY INTERNATIONAL AIRPORT ANG	503	43

Component	Command	State / Country	Installation Name	Gross Square Footage (Thou. SF)	Total Site Delivered Energy (BBtu)
AIR FORCE	ANG	VERMONT	BURLINGTON INTERNATIONAL AIRPORT (ANG)	484	24
AIR FORCE	ANG	VIRGINIA	CAMP PENDLETON MILITARY RESERVATION(ANG)	124	4
AIR FORCE	ANG	WASHINGTON	CAMP MURRAY ANG STATION	235	14
AIR FORCE	ANG	WASHINGTON	FAIRCHILD AIR FORCE BASE	362	23
AIR FORCE	ANG	WEST VIRGINIA	EWVRA SHEPHERD FIELD ANG	652	56
AIR FORCE	ANG	WEST VIRGINIA	YEAGER AIRPORT ANG	437	41
AIR FORCE	ANG	WISCONSIN	DANE COUNTY REGIONAL AIRPORT-TRUAX FIELD	475	40
AIR FORCE	ANG	WISCONSIN	GENERAL MITCHELL INTERNATIONAL APT (ANG)	383	32
AIR FORCE	ANG	WISCONSIN	VOLK FIELD	668	54
AIR FORCE	ANG	WYOMING	CHEYENNE REGIONAL AIRPORT	467	41
AIR FORCE	PACAF	ALASKA	EARECKSON AIR STATION	2,916	723
AIR FORCE	PACAF	ALASKA	EIELSON AIR FORCE BASE	4,018	1,964
AIR FORCE	PACAF	ALASKA	JOINT BASE ELMENDORF-FT RICHARDSON	11,753	1,529
AIR FORCE	PACAF	JAPAN	KADENA AIR BASE	24,483	1,098
AIR FORCE	PACAF	JAPAN	MISAWA AIR BASE	7,575	1,161
AIR FORCE	PACAF	JAPAN	YOKOTA AIR BASE	10,487	1,240
AIR FORCE	PACAF	SOUTH KOREA	KUNSAN AIR BASE	3,644	303
AIR FORCE	PACAF	SOUTH KOREA	OSAN AIR BASE	7,573	515
AIR FORCE	USAFA	COLORADO	USAF ACADEMY	6,702	842
AIR FORCE	USAFE	GERMANY	RAMSTEIN AIR BASE	14,438	1,020
AIR FORCE	USAFE	GERMANY	SPANGDAHLEM AIR BASE	5,124	336
AIR FORCE	USAFE	ITALY	AVIANO AIR BASE	4,268	296
AIR FORCE	USAFE	PORTUGAL	LAJES FIELD	1,460	35
AIR FORCE	USAFE	SPAIN	MORON AIR BASE	744	27
AIR FORCE	USAFE	TURKEY	INCIRLIK AIR BASE ADANA	5,388	258
AIR FORCE	USAFE	UNITED KINGDOM	RAF ALCONBURY	1,561	160
AIR FORCE	USAFE	UNITED KINGDOM	RAF CROUGHTON	1,124	99
AIR FORCE	USAFE	UNITED KINGDOM	RAF FAIRFORD	1,045	37
AIR FORCE	USAFE	UNITED KINGDOM	RAF LAKENHEATH	7,001	519
AIR FORCE	USAFE	UNITED KINGDOM	RAF MILDENHALL	2,882	271
ARMY	AMC	ALABAMA	ANNISTON ARMY DEPOT	9,844	773

Component	Command	State / Country	Installation Name	Gross Square Footage (Thou. SF)	Total Site Delivered Energy (BBtu)
ARMY	AMC	ARKANSAS	PINE BLUFF ARSENAL	3,460	327
ARMY	AMC	CALIFORNIA	MILITARY OCEAN TML CONCORD	266	15
ARMY	AMC	CALIFORNIA	SIERRA ARMY DEPOT	5,344	164
ARMY	AMC	COLORADO	PUEBLO CHEMICAL DEPOT	975	35
ARMY	AMC	IOWA	IOWA AAP (GOCO)	3,686	783
ARMY	AMC	KENTUCKY	BLUE GRASS ARMY DEPOT	4,519	166
ARMY	AMC	MISSOURI	LAKE CITY AAP (GOCO)	2,890	1,054
ARMY	AMC	NEVADA	HAWTHORNE AAP (GOCO)	9,716	163
ARMY	AMC	NEW YORK	WATERVLIET ARSENAL	2,201	323
ARMY	AMC	NORTH CAROLINA	MOT SUNNY POINT	353	14
ARMY	AMC	OHIO	LIMA JSMC	1,610	454
ARMY	AMC	OKLAHOMA	MCALESTER AAP	10,381	505
ARMY	AMC	PENNSYLVANIA	LETTERKENNY ARMY DEPOT	5,398	367
ARMY	AMC	PENNSYLVANIA	SCRANTON AAP	682	431
ARMY	AMC	PENNSYLVANIA	TOBYHANNA ARMY DEPOT	4,460	912
ARMY	AMC	TENNESSEE	HOLSTON AAP (GOCO)	1,773	2,920
ARMY	AMC	TENNESSEE	MILAN AAP (GOCO)	3,317	23
ARMY	AMC	TEXAS	CORPUS CHRISTI AD	2,746	282
ARMY	AMC	TEXAS	RED RIVER DEPOT	7,572	776
ARMY	AMC	UTAH	TOOELE ARMY DEPOT	3,869	90
ARMY	AMC	VIRGINIA	RADFORD AAP (GOCO)	3,038	2,926
ARMY	ARNG	ALABAMA	ALABAMA ARNG	3,629	180
ARMY	ARNG	ALASKA	ALASKA ARNG	289	102
ARMY	ARNG	ARIZONA	ARIZONA ARNG	1,627	92
ARMY	ARNG	ARKANSAS	ARKANSAS ARNG	4,216	217
ARMY	ARNG	CALIFORNIA	CALIFORNIA ARNG	5,136	179
ARMY	ARNG	COLORADO	COLORADO ARNG	531	79
ARMY	ARNG	CONNECTICUT	CONNECTICUT ARNG	1,274	88
ARMY	ARNG	DELAWARE	DELAWARE ARNG	618	33
ARMY	ARNG	DISTRICT OF COLUMBIA	DC ARNG (MOB)	571	39
ARMY	ARNG	FLORIDA	FLORIDA ARNG	2,895	109
ARMY	ARNG	GEORGIA	GEORGIA ARNG	1,745	155
ARMY	ARNG	GUAM	GUAM ARNG (MOB)	273	12
ARMY	ARNG	HAWAII	HAWAII ARNG	1,103	26
ARMY	ARNG	IDAHO	IDAHO ARNG	866	121
ARMY	ARNG	ILLINOIS	ILLINOIS ARNG	2,600	125
ARMY	ARNG	INDIANA	INDIANA ARNG	4,409	379

Component	Command	State / Country	Installation Name	Gross Square Footage (Thou. SF)	Total Site Delivered Energy (BBtu)
ARMY	ARNG	IOWA	IOWA ARNG	3,022	168
ARMY	ARNG	KANSAS	KANSAS ARNG	1,493	116
ARMY	ARNG	KENTUCKY	KENTUCKY ARNG	1,658	75
ARMY	ARNG	LOUISIANA	LOUISIANA ARNG	2,968	206
ARMY	ARNG	MAINE	MAINE ARNG	1,096	68
ARMY	ARNG	MARYLAND	MARYLAND ARNG	1,269	80
ARMY	ARNG	MASSACHUSETTS	MASSACHUSETTS ARNG	1,906	159
ARMY	ARNG	MICHIGAN	MICHIGAN ARNG	3,842	403
ARMY	ARNG	MINNESOTA	MINNESOTA ARNG	4,218	287
ARMY	ARNG	MISSISSIPPI	MISSISSIPPI ARNG	5,746	235
ARMY	ARNG	MISSOURI	MISSOURI ARNG	1,784	142
ARMY	ARNG	MONTANA	MONTANA ARNG	1,453	80
ARMY	ARNG	NEBRASKA	NEBRASKA ARNG	1,567	87
ARMY	ARNG	NEVADA	NEVADA ARNG	527	39
ARMY	ARNG	NEW HAMPSHIRE	NEW HAMPSHIRE ARNG	854	44
ARMY	ARNG	NEW JERSEY	NEW JERSEY ARNG	1,277	143
ARMY	ARNG	NEW MEXICO	NEW MEXICO ARNG	787	68
ARMY	ARNG	NEW YORK	NEW YORK ARNG	2,560	171
ARMY	ARNG	NORTH CAROLINA	NORTH CAROLINA ARNG	1,331	146
ARMY	ARNG	NORTH DAKOTA	NORTH DAKOTA ARNG	1,792	139
ARMY	ARNG	OHIO	OHIO ARNG	3,267	221
ARMY	ARNG	OKLAHOMA	OKLAHOMA ARNG	2,080	129
ARMY	ARNG	OREGON	OREGON ARNG	2,386	115
ARMY	ARNG	PENNSYLVANIA	PENNSYLVANIA ARNG	5,084	368
ARMY	ARNG	PUERTO RICO	PUERTO RICO ARNG (MOB)	1,343	38
ARMY	ARNG	RHODE ISLAND	RHODE ISLAND ARNG	1,221	63
ARMY	ARNG	SOUTH CAROLINA	SOUTH CAROLINA ARNG	1,519	104
ARMY	ARNG	SOUTH DAKOTA	SOUTH DAKOTA ARNG	1,222	69
ARMY	ARNG	TENNESSEE	TENNESSEE ARNG	2,313	126
ARMY	ARNG	TEXAS	TEXAS ARNG	3,397	181
ARMY	ARNG	UTAH	UTAH ARNG	1,941	152
ARMY	ARNG	VERMONT	VERMONT ARNG	1,165	72
ARMY	ARNG	VIRGIN ISLANDS	VIRGIN ISLANDS ARNG (MOB)	290	10
ARMY	ARNG	VIRGINIA	VIRGINIA ARNG	3,314	211
ARMY	ARNG	WASHINGTON	WASHINGTON ARNG	901	62
ARMY	ARNG	WEST VIRGINIA	WEST VIRGINIA ARNG	1,999	168
ARMY	ARNG	WISCONSIN	WISCONSIN ARNG	1,920	199

Component	Command	State / Country	Installation Name	Gross Square Footage (Thou. SF)	Total Site Delivered Energy (BBtu)
ARMY	ARNG	WYOMING	WYOMING ARNG	846	99
ARMY	IMCOM	ALABAMA	FORT RUCKER	5,825	547
ARMY	IMCOM	ALABAMA	REDSTONE ARSENAL	11,904	1,514
ARMY	IMCOM	ALASKA	FORT GREELY	1,069	288
ARMY	IMCOM	ALASKA	FORT WAINWRIGHT	6,862	1,499
ARMY	IMCOM	ARIZONA	FORT HUACHUCA	5,737	497
ARMY	IMCOM	ARIZONA	YUMA PROVING GROUND	1,884	138
ARMY	IMCOM	BELGIUM	USAG BENELUX	5,785	170
ARMY	IMCOM	CALIFORNIA	FORT IRWIN	4,529	429
ARMY	IMCOM	CALIFORNIA	PRESIDIO OF MONTEREY	2,722	180
ARMY	IMCOM	COLORADO	FORT CARSON	14,939	1,529
ARMY	IMCOM	FLORIDA	USAG MIAMI	782	92
ARMY	IMCOM	GEORGIA	FORT BENNING	20,744	1,595
ARMY	IMCOM	GEORGIA	FORT GORDON	10,651	889
ARMY	IMCOM	GEORGIA	FORT STEWART	15,047	1,173
ARMY	IMCOM	GERMANY	USAG ANSBACH	7,147	310
ARMY	IMCOM	GERMANY	USAG BAVARIA	23,896	1,589
ARMY	IMCOM	GERMANY	USAG RHEINLAND-PFALZ	24,954	1,266
ARMY	IMCOM	GERMANY	USAG STUTTGART	8,528	548
ARMY	IMCOM	GERMANY	USAG WIESBADEN	9,828	529
ARMY	IMCOM	HAWAII	USAG HAWAII	14,641	871
ARMY	IMCOM	ILLINOIS	ROCK ISLAND ARSENAL	6,557	576
ARMY	IMCOM	ITALY	USAG VICENZA	8,091	635
ARMY	IMCOM	JAPAN	CAMP ZAMA JAPAN	10,408	653
ARMY	IMCOM	KANSAS	FORT LEAVENWORTH	4,503	403
ARMY	IMCOM	KANSAS	FORT RILEY	11,420	992
ARMY	IMCOM	KENTUCKY	FORT CAMPBELL	17,118	1,648
ARMY	IMCOM	KENTUCKY	FORT KNOX	11,655	1,494
ARMY	IMCOM	LOUISIANA	FORT POLK	7,780	739
ARMY	IMCOM	MARSHALL ISLANDS	KWAJALEIN ATOLL	3,348	998
ARMY	IMCOM	MARYLAND	ABERDEEN PG	14,679	2,842
ARMY	IMCOM	MARYLAND	ADELPHI LABORATORY CTR	1,168	233
ARMY	IMCOM	MARYLAND	FORT DETRICK	3,471	923
ARMY	IMCOM	MARYLAND	FORT GEORGE MEADE	12,003	674
ARMY	IMCOM	MASSACHUSETTS	SOLDIER SYSTEMS CTR, NATICK	998	112
ARMY	IMCOM	MICHIGAN	USAG DETROIT ARSENAL	1,956	219
ARMY	IMCOM	MISSOURI	FORT LEONARD WOOD	12,195	1,501
ARMY	IMCOM	NEW JERSEY	PICATINNY ARSENAL	3,343	548

Component	Command	State / Country	Installation Name	Gross Square Footage (Thou. SF)	Total Site Delivered Energy (BBtu)
ARMY	IMCOM	NEW MEXICO	WHITE SANDS MISSILE RANGE	4,791	310
ARMY	IMCOM	NEW YORK	FORT DRUM	12,318	1,218
ARMY	IMCOM	NEW YORK	FORT HAMILTON	693	63
ARMY	IMCOM	NEW YORK	WEST POINT MIL RESERVATION	7,957	911
ARMY	IMCOM	NORTH CAROLINA	FORT BRAGG	35,017	3,296
ARMY	IMCOM	OKLAHOMA	FORT SILL	12,341	1,172
ARMY	IMCOM	PENNSYLVANIA	CARLISLE BARRACKS	1,132	118
ARMY	IMCOM	SOUTH CAROLINA	FORT JACKSON	10,427	837
ARMY	IMCOM	SOUTH KOREA	USAG DAEGU	7,156	457
ARMY	IMCOM	SOUTH KOREA	USAG HUMPHREYS	19,060	1,649
ARMY	IMCOM	SOUTH KOREA	USAG RED CLOUD	8,245	745
ARMY	IMCOM	SOUTH KOREA	USAG YONGSAN	7,125	698
ARMY	IMCOM	TEXAS	FORT BLISS	22,664	1,572
ARMY	IMCOM	TEXAS	FORT HOOD	22,995	1,997
ARMY	IMCOM	UTAH	DUGWAY PROVING GROUND	1,968	278
ARMY	IMCOM	VIRGINIA	FORT A P HILL	1,491	75
ARMY	IMCOM	VIRGINIA	FORT BELVOIR	13,290	1,125
ARMY	IMCOM	VIRGINIA	FORT LEE	10,257	794
ARMY	IMCOM	VIRGINIA	JOINT BASE MYER-HENDERSON HALL	3,854	420
ARMY	IMCOM	WASHINGTON	JOINT BASE LEWIS MCCHORD	26,740	2,035
ARMY	USAR	CALIFORNIA	63RD RSC	5,802	245
ARMY	USAR	CALIFORNIA	FORT HUNTER LIGGETT	1,453	39
ARMY	USAR	CALIFORNIA	PARKS CSTC	1,241	48
ARMY	USAR	HAWAII	9TH MSC	192	9
ARMY	USAR	MASSACHUSETTS	DEVENS RFTA	1,133	87
ARMY	USAR	NEW JERSEY	99TH RSC	7,486	379
ARMY	USAR	PUERTO RICO	FORT BUCHANAN	1,766	137
ARMY	USAR	SOUTH CAROLINA	81ST RSC	6,072	233
ARMY	USAR	WISCONSIN	88TH RSC	9,481	638
ARMY	USAR	WISCONSIN	FORT MCCOY	6,903	401
DCMA	DCMA	CALIFORNIA	DCMA CARSON	85	9
DCMA	DCMA	OHIO	DCMA CLEVELAND	78	9
DECA	DECA	ALABAMA	FORT RUCKER	84	8
DECA	DECA	ALABAMA	MAXWELL AIR FORCE BASE	42	6
DECA	DECA	ALABAMA	MAXWELL AIR FORCE BASE	87	13
DECA	DECA	ALABAMA	REDSTONE ARSENAL	81	12
DECA	DECA	ALASKA	EIELSON AIR FORCE BASE	42	7

Component	Command	State / Country	Installation Name	Gross Square Footage (Thou. SF)	Total Site Delivered Energy (BBtu)
DECA	DECA	ALASKA	FORT GREELY	25	3
DECA	DECA	ALASKA	FORT WAINWRIGHT	104	11
DECA	DECA	ALASKA	JOINT BASE ELMENDORF-FT RICHARDSON	105	11
DECA	DECA	ARIZONA	DAVIS-MONTHAN AIR FORCE BASE	115	13
DECA	DECA	ARIZONA	FORT HUACHUCA	78	7
DECA	DECA	ARIZONA	LUKE AIR FORCE BASE	102	10
DECA	DECA	ARIZONA	MCAS YUMA AZ	34	5
DECA	DECA	ARIZONA	YUMA PROVING GROUND	23	2
DECA	DECA	ARKANSAS	LITTLE ROCK AIR FORCE BASE	100	11
DECA	DECA	BELGIUM	US ARMY GARRISON BENELUX	46	9
DECA	DECA	CALIFORNIA	BEALE AIR FORCE BASE	75	6
DECA	DECA	CALIFORNIA	BEALE AIR FORCE BASE	88	13
DECA	DECA	CALIFORNIA	BEALE AIR FORCE BASE	37	7
DECA	DECA	CALIFORNIA	COMBAT SUPPORT TRAINING CENTER AND CAMP PARKS	8	2
DECA	DECA	CALIFORNIA	CSO NAS MOFFETT FIELD CA	52	3
DECA	DECA	CALIFORNIA	EDWARDS AIR FORCE BASE	60	6
DECA	DECA	CALIFORNIA	LOS ANGELES AIR FORCE BASE	75	7
DECA	DECA	CALIFORNIA	MARCH AIR RESERVE BASE	117	10
DECA	DECA	CALIFORNIA	MCAGCC TWENTYNINE PALMS CA	13	2
DECA	DECA	CALIFORNIA	MCAGCC TWENTYNINE PALMS CA	57	8
DECA	DECA	CALIFORNIA	MCAS MIRAMAR	91	11
DECA	DECA	CALIFORNIA	MCB CAMP PENDLETON CA	113	13
DECA	DECA	CALIFORNIA	MCB CAMP PENDLETON CA	20	3
DECA	DECA	CALIFORNIA	MCLB BARSTOW CA	22	3
DECA	DECA	CALIFORNIA	NAF EL CENTRO CA	13	2
DECA	DECA	CALIFORNIA	NAS LEMOORE CA	44	7
DECA	DECA	CALIFORNIA	NATIONAL TRAINING CENTER AND FORT IRWIN	57	7
DECA	DECA	CALIFORNIA	NAVBASE CORONADO	46	7
DECA	DECA	CALIFORNIA	NAVBASE CORONADO	78	13
DECA	DECA	CALIFORNIA	NAVBASE SAN DIEGO CA	128	16
DECA	DECA	CALIFORNIA	NAVBASE VENTURA CTY PT MUGU CA	65	7
DECA	DECA	CALIFORNIA	NAWS CHINA LAKE	24	3
DECA	DECA	CALIFORNIA	PRESIDIO OF MONTEREY	111	10
DECA	DECA	CALIFORNIA	TRAVIS AIR FORCE BASE	97	14
DECA	DECA	CALIFORNIA	VANDENBERG AIR FORCE BASE	83	5
DECA	DECA	COLORADO	BUCKLEY AIR FORCE BASE	77	9

Component	Command	State / Country	Installation Name	Gross Square Footage (Thou. SF)	Total Site Delivered Energy (BBtu)
DECA	DECA	COLORADO	FORT CARSON	122	17
DECA	DECA	COLORADO	PETERSON AIR FORCE BASE	102	13
DECA	DECA	COLORADO	USAF ACADEMY	67	10
DECA	DECA	CONNECTICUT	NAVSUBASE NEW LONDON CT	57	9
DECA	DECA	CONNECTICUT	NAVSUBASE NEW LONDON CT	28	4
DECA	DECA	DELAWARE	DOVER AIR FORCE BASE	78	4
DECA	DECA	DISTRICT OF COLUMBIA	JBAB ANACOSTIA BOLLING	72	12
DECA	DECA	FLORIDA	EGLIN AIR FORCE BASE	107	14
DECA	DECA	FLORIDA	EGLIN AIR FORCE BASE	63	10
DECA	DECA	FLORIDA	MACDILL AIR FORCE BASE	171	13
DECA	DECA	FLORIDA	NAS JACKSONVILLE FL	114	13
DECA	DECA	FLORIDA	NAS KEY WEST FL	21	3
DECA	DECA	FLORIDA	NAS PENSACOLA FL	74	12
DECA	DECA	FLORIDA	NAS WHITING FLD MILTON FL	22	5
DECA	DECA	FLORIDA	NAVSTA MAYPORT FL	71	9
DECA	DECA	FLORIDA	PATRICK AIR FORCE BASE	103	12
DECA	DECA	FLORIDA	TYNDALL AIR FORCE BASE	76	7
DECA	DECA	GEORGIA	FORT BENNING	3	0
DECA	DECA	GEORGIA	FORT BENNING	118	19
DECA	DECA	GEORGIA	FORT GORDON	92	11
DECA	DECA	GEORGIA	FORT STEWART	58	8
DECA	DECA	GEORGIA	FORT STEWART	95	12
DECA	DECA	GEORGIA	MCLB ALBANY GA	37	6
DECA	DECA	GEORGIA	MOODY AIR FORCE BASE	64	8
DECA	DECA	GEORGIA	ROBINS AIR FORCE BASE	70	10
DECA	DECA	GEORGIA	SUBASE KINGS BAY GA	53	8
DECA	DECA	GERMANY	RAMSTEIN AIR BASE	178	26
DECA	DECA	GERMANY	RAMSTEIN AIR BASE	95	13
DECA	DECA	GERMANY	RAMSTEIN AIR BASE	59	10
DECA	DECA	GERMANY	RAMSTEIN AIR BASE	41	8
DECA	DECA	GERMANY	RAMSTEIN AIR BASE	37	2
DECA	DECA	GERMANY	SPANGDAHLEM AIR BASE	54	7
DECA	DECA	GERMANY	US ARMY GARRISON ANSBACH	58	8
DECA	DECA	GERMANY	US ARMY GARRISON BAUMHOLDER	32	5
DECA	DECA	GERMANY	US ARMY GARRISON GRAFENWOEHR	55	11
DECA	DECA	GERMANY	US ARMY GARRISON GRAFENWOEHR	52	7
DECA	DECA	GERMANY	US ARMY GARRISON GRAFENWOEHR	14	1

Component	Command	State / Country	Installation Name	Gross Square Footage (Thou. SF)	Total Site Delivered Energy (BBtu)
DECA	DECA	GERMANY	US ARMY GARRISON HEIDELBERG	789	22
DECA	DECA	GERMANY	US ARMY GARRISON HOHENFELS	38	5
DECA	DECA	GERMANY	US ARMY GARRISON STUTTGART	41	7
DECA	DECA	GERMANY	US ARMY GARRISON STUTTGART	64	5
DECA	DECA	GERMANY	US ARMY GARRISON STUTTGART	18	2
DECA	DECA	GERMANY	US ARMY GARRISON STUTTGART	5	1
DECA	DECA	GERMANY	US ARMY GARRISON WIESBADEN	62	9
DECA	DECA	GUAM	NAVBASE GUAM	187	13
DECA	DECA	GUAM	NAVBASE GUAM	57	9
DECA	DECA	GUAM	NSA ANDERSEN	122	11
DECA	DECA	HAWAII	JBPHH PEARL HARBOR - HICKAM HAWAII	115	13
DECA	DECA	HAWAII	JBPHH PEARL HARBOR - HICKAM HAWAII	98	12
DECA	DECA	HAWAII	MCB HAWAII KANEOHE	77	12
DECA	DECA	HAWAII	SCHOFIELD BARRACKS	92	11
DECA	DECA	IDAHO	MOUNTAIN HOME AIR FORCE BASE	54	6
DECA	DECA	ILLINOIS	NAVAL STATION GREAT LAKES IL	60	8
DECA	DECA	ILLINOIS	ROCK ISLAND ARSENAL	33	3
DECA	DECA	ILLINOIS	SCOTT AIR FORCE BASE	114	17
DECA	DECA	INDIANA	88TH REGIONAL SUPPORT COMMAND	54	8
DECA	DECA	INDIANA	NAVAL SUPPORT ACTIVITY CRANE	8	1
DECA	DECA	ITALY	AVIANO AIR BASE	64	11
DECA	DECA	ITALY	NAS SIGONELLA IT	68	12
DECA	DECA	ITALY	NAVSUPPACT NAPLES IT	85	14
DECA	DECA	ITALY	US ARMY GARRISON LIVORNO	26	3
DECA	DECA	ITALY	US ARMY GARRISON VICENZA	55	9
DECA	DECA	JAPAN	CAMP ZAMA	186	10
DECA	DECA	JAPAN	CAMP ZAMA	67	6
DECA	DECA	JAPAN	CAMP ZAMA	14	2
DECA	DECA	JAPAN	CAMP ZAMA	2	1
DECA	DECA	JAPAN	COMFLEACT SASEBO JA	24	3
DECA	DECA	JAPAN	COMFLEACT SASEBO JA	20	3
DECA	DECA	JAPAN	COMFLEACT YOKOSUKA JA	96	17
DECA	DECA	JAPAN	COMFLEACT YOKOSUKA JA	86	14
DECA	DECA	JAPAN	KADENA AIR BASE	87	15
DECA	DECA	JAPAN	MCAS IWAKUNI JA	54	10

Component	Command	State / Country	Installation Name	Gross Square Footage (Thou. SF)	Total Site Delivered Energy (BBtu)
DECA	DECA	JAPAN	MCB CAMP S D BUTLER OKINAWA JA	291	12
DECA	DECA	JAPAN	MCB CAMP S D BUTLER OKINAWA JA	59	8
DECA	DECA	JAPAN	MCB CAMP S D BUTLER OKINAWA JA	31	6
DECA	DECA	JAPAN	MCB CAMP S D BUTLER OKINAWA JA	31	5
DECA	DECA	JAPAN	MISAWA AIR BASE	82	10
DECA	DECA	JAPAN	NAF ATSUGI JA	32	4
DECA	DECA	JAPAN	YOKOTA AIR BASE	81	21
DECA	DECA	KANSAS	FORT LEAVENWORTH	74	12
DECA	DECA	KANSAS	FORT RILEY	113	16
DECA	DECA	KANSAS	MCCONNELL AIR FORCE BASE	56	9
DECA	DECA	KENTUCKY	FORT CAMPBELL	122	15
DECA	DECA	KENTUCKY	FORT KNOX	122	12
DECA	DECA	LOUISIANA	BARKSDALE AIR FORCE BASE	104	11
DECA	DECA	LOUISIANA	FORT POLK	82	10
DECA	DECA	LOUISIANA	NAS JRB NEW ORLEANS LA	47	7
DECA	DECA	MAINE	BANGOR INTERNATIONAL AIRPORT (ANG)	29	5
DECA	DECA	MAINE	NSY PORTSMOUTH	28	6
DECA	DECA	MARYLAND	ABERDEEN PROVING GROUND	62	8
DECA	DECA	MARYLAND	FORT DETRICK	39	5
DECA	DECA	MARYLAND	FORT DETRICK	58	8
DECA	DECA	MARYLAND	FORT GEORGE G MEADE	118	20
DECA	DECA	MARYLAND	JOINT BASE ANDREWS-NAVAL AIR FACILITY WASHINGTON	113	17
DECA	DECA	MARYLAND	NAVAL AIR STATION PAX RIVER	56	7
DECA	DECA	MARYLAND	NAVSUPPACT ANNAPOLIS	48	8
DECA	DECA	MASSACHUSETTS	HANSCOM AIR FORCE BASE	73	13
DECA	DECA	MICHIGAN	SELFRIDGE ANG BASE	76	8
DECA	DECA	MISSISSIPPI	CBC GULFPORT MS	31	6
DECA	DECA	MISSISSIPPI	COLUMBUS AIR FORCE BASE	49	6
DECA	DECA	MISSISSIPPI	KEESLER AIR FORCE BASE	98	14
DECA	DECA	MISSISSIPPI	NAS MERIDIAN MS	32	5
DECA	DECA	MISSOURI	FORT LEONARD WOOD	71	12
DECA	DECA	MISSOURI	MCSPTACT KANSAS CITY MO	24	3
DECA	DECA	MISSOURI	WHITEMAN AIR FORCE BASE	61	8
DECA	DECA	MONTANA	MALMSTROM AIR FORCE BASE	68	7
DECA	DECA	NEBRASKA	OFFUTT AIR FORCE BASE	120	16
DECA	DECA	NETHERLANDS	US ARMY GARRISON SCHINNEN	24	6

Component	Command	State / Country	Installation Name	Gross Square Footage (Thou. SF)	Total Site Delivered Energy (BBtu)
DECA	DECA	NEVADA	NAS FALLON NV	40	3
DECA	DECA	NEVADA	NELLIS AIR FORCE BASE	130	9
DECA	DECA	NEW JERSEY	MCGUIRE AIR FORCE BASE	18	2
DECA	DECA	NEW JERSEY	MCGUIRE AIR FORCE BASE	103	14
DECA	DECA	NEW JERSEY	PICATINNY ARSENAL	22	4
DECA	DECA	NEW MEXICO	CANNON AIR FORCE BASE	58	6
DECA	DECA	NEW MEXICO	HOLLOMAN AIR FORCE BASE	69	4
DECA	DECA	NEW MEXICO	KIRTLAND AIR FORCE BASE	108	11
DECA	DECA	NEW MEXICO	WHITE SANDS MISSILE RANGE	32	4
DECA	DECA	NEW YORK	FORT DRUM	83	14
DECA	DECA	NEW YORK	FORT HAMILTON	50	11
DECA	DECA	NEW YORK	NSA SARATOGA SPRINGS NY	22	4
DECA	DECA	NEW YORK	WEST POINT MILITARY RESERVATION	73	12
DECA	DECA	NORTH CAROLINA	FORT BRAGG	95	13
DECA	DECA	NORTH CAROLINA	FORT BRAGG	118	14
DECA	DECA	NORTH CAROLINA	MCAS CHERRY POINT NC	59	5
DECA	DECA	NORTH CAROLINA	MCB CAMP LEJEUNE NC	46	7
DECA	DECA	NORTH CAROLINA	MCB CAMP LEJEUNE NC	76	8
DECA	DECA	NORTH CAROLINA	SEYMOUR JOHNSON AIR FORCE BASE	66	9
DECA	DECA	NORTH DAKOTA	GRAND FORKS AIR FORCE BASE	41	5
DECA	DECA	NORTH DAKOTA	MINOT AIR FORCE BASE	56	10
DECA	DECA	OHIO	WRIGHT PATTERSON AIR FORCE BASE	123	14
DECA	DECA	OKLAHOMA	ALTUS AIR FORCE BASE	58	7
DECA	DECA	OKLAHOMA	FORT SILL	102	21
DECA	DECA	OKLAHOMA	TINKER AIR FORCE BASE	87	10
DECA	DECA	OKLAHOMA	VANCE AIR FORCE BASE	34	5
DECA	DECA	PENNSYLVANIA	99TH REGIONAL SUPPORT COMMAND	43	7
DECA	DECA	PENNSYLVANIA	CARLISLE BARRACKS	60	6
DECA	DECA	PENNSYLVANIA	TOBYHANNA ARMY DEPOT	22	4
DECA	DECA	PORTUGAL	LAJES FIELD	58	3
DECA	DECA	PUERTO RICO	FORT BUCHANAN	95	12
DECA	DECA	RHODE ISLAND	NAVAL STATION NEWPORT RI	46	6
DECA	DECA	SOUTH CAROLINA	CHARLESTON AIR FORCE BASE	86	8
DECA	DECA	SOUTH CAROLINA	CHARLESTON AIR FORCE BASE	64	11
DECA	DECA	SOUTH CAROLINA	FORT JACKSON	130	11

Component	Command	State / Country	Installation Name	Gross Square Footage (Thou. SF)	Total Site Delivered Energy (BBtu)
DECA	DECA	SOUTH CAROLINA	MCRD BEAUFORT PI SC	44	3
DECA	DECA	SOUTH CAROLINA	SHAW AIR FORCE BASE	61	10
DECA	DECA	SOUTH DAKOTA	ELLSWORTH AIR FORCE BASE	72	10
DECA	DECA	SOUTH KOREA	CAMP CASEY	17	3
DECA	DECA	SOUTH KOREA	CAMP HENRY	8	1
DECA	DECA	SOUTH KOREA	CAMP HENRY	16	1
DECA	DECA	SOUTH KOREA	CAMP HENRY	38	4
DECA	DECA	SOUTH KOREA	CAMP HUMPHREYS	90	11
DECA	DECA	SOUTH KOREA	FLEET ACTIVITIES CHINHAE KS	11	2
DECA	DECA	SOUTH KOREA	KUNSAN AIR BASE	16	4
DECA	DECA	SOUTH KOREA	OSAN AIR BASE	60	7
DECA	DECA	SOUTH KOREA	OSAN AIR BASE	49	6
DECA	DECA	SOUTH KOREA	YONGSAN GARRISON	94	13
DECA	DECA	SOUTH KOREA	YONGSAN GARRISON	89	1
DECA	DECA	SOUTH KOREA	YONGSAN GARRISON	7	1
DECA	DECA	SPAIN	NAVSTA ROTA SP	50	7
DECA	DECA	TENNESSEE	ARNOLD AIR STATION	23	4
DECA	DECA	TENNESSEE	NAVSUPPACT MIDSOUTH MEMPHIS TN	61	12
DECA	DECA	TEXAS	DYESS AIR FORCE BASE	80	7
DECA	DECA	TEXAS	FORT BLISS	123	12
DECA	DECA	TEXAS	FORT HOOD	106	9
DECA	DECA	TEXAS	FORT HOOD	128	16
DECA	DECA	TEXAS	GOODFELLOW AIR FORCE BASE	57	7
DECA	DECA	TEXAS	JBSA - FORT SAM HOUSTON	104	15
DECA	DECA	TEXAS	JBSA - LACKLAND	117	13
DECA	DECA	TEXAS	JBSA - RANDOLPH	97	15
DECA	DECA	TEXAS	LAUGHLIN AIR FORCE BASE	75	5
DECA	DECA	TEXAS	NAS CORPUS CHRISTI TX	46	7
DECA	DECA	TEXAS	NAS JRB FT WORTH TX	93	16
DECA	DECA	TEXAS	NAS KINGSVILLE TX	15	2
DECA	DECA	TEXAS	SHEPPARD AIR FORCE BASE	81	10
DECA	DECA	TURKEY	INCIRLIK AIR BASE ADANA	67	6
DECA	DECA	TURKEY	INCIRLIK AIR BASE ADANA	15	1
DECA	DECA	UNITED KINGDOM	RAF ALCONBURY	77	10
DECA	DECA	UNITED KINGDOM	RAF CROUGHTON	20	3
DECA	DECA	UNITED KINGDOM	RAF LAKENHEATH	112	17

Component	Command	State / Country	Installation Name	Gross Square Footage (Thou. SF)	Total Site Delivered Energy (BBtu)
DECA	DECA	UNITED KINGDOM	RAF MENWITH HILL	34	5
DECA	DECA	UNITED KINGDOM	RAF MILDENHALL	14	2
DECA	DECA	UTAH	DUGWAY PROVING GROUND	18	3
DECA	DECA	UTAH	HILL AIR FORCE BASE	87	10
DECA	DECA	VIRGINIA	FORT BELVOIR	142	20
DECA	DECA	VIRGINIA	FORT LEE	81	12
DECA	DECA	VIRGINIA	FORT LEE	242	24
DECA	DECA	VIRGINIA	JNTEXPBASE LITTLE CREEK FS VA	100	12
DECA	DECA	VIRGINIA	JOINT BASE MYER-HENDERSON HALL	74	8
DECA	DECA	VIRGINIA	LANGLEY AIR FORCE BASE	103	11
DECA	DECA	VIRGINIA	LANGLEY AIR FORCE BASE	103	17
DECA	DECA	VIRGINIA	MARINE CORPS BASE QUANTICO VA	121	14
DECA	DECA	VIRGINIA	NAS OCEANA VA	110	15
DECA	DECA	VIRGINIA	NAVSTA NORFOLK VA	79	11
DECA	DECA	VIRGINIA	NAVSUPPACT NORFOLK NSY	62	8
DECA	DECA	VIRGINIA	NSA SOUTH POTOMAC	15	3
DECA	DECA	WASHINGTON	FAIRCHILD AIR FORCE BASE	85	10
DECA	DECA	WASHINGTON	JOINT BASE LEWIS-MCCHORD	105	12
DECA	DECA	WASHINGTON	JOINT BASE LEWIS-MCCHORD	148	14
DECA	DECA	WASHINGTON	NAS WHIDBEY ISLAND WA	66	10
DECA	DECA	WASHINGTON	NAVAL BASE KITSAP BREMERTON WA	61	9
DECA	DECA	WASHINGTON	NAVAL BASE KITSAP BREMERTON WA	48	7
DECA	DECA	WASHINGTON	NAVSTA EVERETT WA	60	7
DECA	DECA	WISCONSIN	FORT MCCOY	16	4
DECA	DECA	WYOMING	FRANCIS E WARREN AIR FORCE BASE	77	8
DFAS	Limestone	MAINE	DFAS LIMESTONE	141	9
DFAS	ROME	NEW YORK	DFAS ROME	332	27
DIA	DIA	DISTRICT OF COLUMBIA	JOINT BASE ANACOSTIA BOLLING	1,400	148
DIA	DIA	MARYLAND	DLOC	400	54
DIA	DIA	VIRGINIA	ROWE BLDG AND ULC 1/RIVANNA	600	22
DLA	DDJC	CALIFORNIA	DEFENSE DISTRIBUTION DEPOT SAN JOAQUIN	5,279	105
DLA	DDSP	PENNSYLVANIA	DEFENSE DISTRIBUTION DEPOT SUSQUEHANNA	6,977	316
DLA	DSCC	OHIO	DEFENSE SUPPLY CENTER COLUMBUS	3,841	365
DLA	DSCR	VIRGINIA	DEFENSE SUPPLY CENTER RICHMOND	4,694	285
NAVY	NAVY	BAHRAIN	NAVSUPPACT BAHRAIN	2,884	271

Component	Command	State / Country	Installation Name	Gross Square Footage (Thou. SF)	Total Site Delivered Energy (BBtu)
NAVY	NAVY	CALIFORNIA	NAF EL CENTRO CA	1,194	85
NAVY	NAVY	CALIFORNIA	NAS LEMOORE CA	3,854	457
NAVY	NAVY	CALIFORNIA	NAVBASE CORONADO	14,779	1,306
NAVY	NAVY	CALIFORNIA	NAVBASE POINT LOMA	6,605	502
NAVY	NAVY	CALIFORNIA	NAVBASE SAN DIEGO CA	9,346	1,884
NAVY	NAVY	CALIFORNIA	NAVBASE VENTURA CTY PT MUGU CA	9,361	376
NAVY	NAVY	CALIFORNIA	NAVSUPPDET MONTEREY CA	1,825	135
NAVY	NAVY	CALIFORNIA	NAVWPNSTA SEAL BEACH	2,038	82
NAVY	NAVY	CALIFORNIA	NAWS CHINA LAKE	4,666	743
NAVY	NAVY	CONNECTICUT	SUBASE NEW LONDON CT	3,125	841
NAVY	NAVY	CUBA	NAVSTA GUANTANAMO BAY	6,506	1,150
NAVY	NAVY	DIEGO GARCIA	NAVSUPPFAC DIEGO GARCIA IO	2,690	856
NAVY	NAVY	DISTRICT OF COLUMBIA	JBAB ANACOSTIA BOLLING	6,980	416
NAVY	NAVY	DISTRICT OF COLUMBIA	NAVAL SUPPORT ACTIVITY WASH	9,776	1,607
NAVY	NAVY	DJIBOUTI	CAMP LEMONNIER DJIBOUTI	1,875	913
NAVY	NAVY	FLORIDA	NAS JACKSONVILLE FL	8,859	955
NAVY	NAVY	FLORIDA	NAS KEY WEST FL	2,941	280
NAVY	NAVY	FLORIDA	NAS PENSACOLA FL	11,660	1,176
NAVY	NAVY	FLORIDA	NAS WHITING FLD MILTON FL	1,355	98
NAVY	NAVY	FLORIDA	NAVAL SUPPORT ACTIVITY ORLANDO	308	27
NAVY	NAVY	FLORIDA	NAVAL SUPPORT ACTY PANAMA CITY	1,546	118
NAVY	NAVY	FLORIDA	NAVSTA MAYPORT FL	2,684	476
NAVY	NAVY	GEORGIA	SUBASE KINGS BAY GA	5,334	745
NAVY	NAVY	GREECE	NAVSUPPACT SOUDA BAY GR	514	31
NAVY	NAVY	GUAM	NAVBASE GUAM	11,204	716
NAVY	NAVY	GUAM	NSA ANDERSEN	6,496	325
NAVY	NAVY	HAWAII	CNIC PMRF BARKING SANDS	651	87
NAVY	NAVY	HAWAII	JBPHH PEARL HARBOR - HICKAM HAWAII	21,110	1,852
NAVY	NAVY	ILLINOIS	NAVAL STATION GREAT LAKES IL	9,528	1,066
NAVY	NAVY	INDIANA	NAVAL SUPPORT ACTIVITY CRANE	4,233	759
NAVY	NAVY	ITALY	NAS SIGONELLA IT	3,075	216
NAVY	NAVY	ITALY	NAVSUPPACT NAPLES IT	5,651	375
NAVY	NAVY	JAPAN	COMFLEACT OKINAWA JA	1,088	67
NAVY	NAVY	JAPAN	COMFLEACT SASEBO JA	4,448	424
NAVY	NAVY	JAPAN	COMFLEACT YOKOSUKA JA	12,869	2,947
NAVY	NAVY	JAPAN	NAF ATSUGI JA	4,102	305

Component	Command	State / Country	Installation Name	Gross Square Footage (Thou. SF)	Total Site Delivered Energy (BBtu)
NAVY	NAVY	JAPAN	NAF MISAWA JA	907	102
NAVY	NAVY	LOUISIANA	NAS JRB NEW ORLEANS LA	2,283	189
NAVY	NAVY	MAINE	NSY PORTSMOUTH	4,455	1,167
NAVY	NAVY	MARYLAND	NAVAL AIR STATION PAX RIVER	8,581	1,019
NAVY	NAVY	MARYLAND	NAVSUPPACT ANNAPOLIS	6,023	703
NAVY	NAVY	MARYLAND	NAVSUPPACT BETHESDA MD	7,594	1,214
NAVY	NAVY	MISSISSIPPI	CBC GULFPORT MS	4,592	146
NAVY	NAVY	MISSISSIPPI	NAS MERIDIAN MS	1,602	145
NAVY	NAVY	NEVADA	NAS FALLON NV	2,188	241
NAVY	NAVY	NEW JERSEY	NAVAL WEAPONS STATION EARLE NJ	1,240	164
NAVY	NAVY	NEW YORK	NSA SARATOGA SPRINGS NY	40	3
NAVY	NAVY	NORTH CAROLINA	FRC EAST CHERRY POINT NC	6,571	693
NAVY	NAVY	PENNSYLVANIA	NAVSUPPACT MECHANICSBURG PA	11,195	664
NAVY	NAVY	RHODE ISLAND	NAVAL STATION NEWPORT RI	6,118	698
NAVY	NAVY	ROMANIA	NSF DEVESELU RO	117	9
NAVY	NAVY	SINGAPORE	SINGAPORE AREA COORDINATOR	1,157	44
NAVY	NAVY	SOUTH CAROLINA	NAVHOSP BEAUFORT SC	431	63
NAVY	NAVY	SOUTH KOREA	FLEET ACTIVITIES CHINHAE KS	478	30
NAVY	NAVY	SPAIN	NAVSTA ROTA SP	3,721	248
NAVY	NAVY	TENNESSEE	NAVSUPPACT MIDSOUTH MEMPHIS TN	2,785	197
NAVY	NAVY	TEXAS	NAS CORPUS CHRISTI TX	2,773	187
NAVY	NAVY	TEXAS	NAS JRB FT WORTH TX	3,679	284
NAVY	NAVY	TEXAS	NAS KINGSVILLE TX	1,153	132
NAVY	NAVY	VIRGINIA	JNTEXPBASE LITTLE CREEK FS VA	5,852	742
NAVY	NAVY	VIRGINIA	NAS OCEANA VA	8,049	701
NAVY	NAVY	VIRGINIA	NAVAL WEAPONS STATION YORKTOWN	6,089	207
NAVY	NAVY	VIRGINIA	NAVSTA NORFOLK VA	15,513	3,675
NAVY	NAVY	VIRGINIA	NAVSUPPACT HAMPTON ROADS VA	7,319	924
NAVY	NAVY	VIRGINIA	NAVSUPPACT NORFOLK NSY	7,476	2,592
NAVY	NAVY	VIRGINIA	NSA SOUTH POTOMAC	6,461	1,359
NAVY	NAVY	WASHINGTON	CNI NAVMAG INDIAN ISLAND	376	18
NAVY	NAVY	WASHINGTON	NAS WHIDBEY ISLAND WA	3,894	441
NAVY	NAVY	WASHINGTON	NAVAL BASE KITSAP BREMERTON WA	15,228	2,782
NAVY	NAVY	WASHINGTON	NAVSTA EVERETT WA	1,970	349
NGA	NGA	VIRGINIA	NGA	6,653	700

Component	Command	State / Country	Installation Name	Gross Square Footage (Thou. SF)	Total Site Delivered Energy (BBtu)
NRO	NRO	CALIFORNIA	VANDENBERG AIR FORCE BASE	435	28
NRO	NRO	COLORADO	BUCKLEY AIR FORCE BASE	1,255	546
NRO	NRO	FLORIDA	PATRICK AIR FORCE BASE	760	66
NRO	NRO	NEW MEXICO	WHITE SANDS MISSILE RANGE	235	82
NRO	NRO	VIRGINIA	FORT BELVOIR	1,454	341
NRO	NRO	VIRGINIA	NRO HEADQUARTERS	1,520	168
NSA	NSA	MARYLAND	FORT GEORGE G MEADE	29,130	4,427
USMC	USMC	ARIZONA	MCAS YUMA AZ	3,395	234
USMC	USMC	CALIFORNIA	MARCORPRCUITDEP SAN DIEGO CA	2,718	151
USMC	USMC	CALIFORNIA	MCAGCC TWENTYNINE PALMS CA	6,896	1,233
USMC	USMC	CALIFORNIA	MCAS CAMP PENDLETON CA	1,220	63
USMC	USMC	CALIFORNIA	MCAS MIRAMAR	6,461	308
USMC	USMC	CALIFORNIA	MCB CAMP PENDLETON CA	21,038	1,045
USMC	USMC	CALIFORNIA	MCLB BARSTOW CA	4,628	240
USMC	USMC	CALIFORNIA	MCMWTC BRIDGEPORT CA	319	47
USMC	USMC	CALIFORNIA	NAVAL HOSPITAL 29 PALMS CA	233	41
USMC	USMC	CALIFORNIA	NAVAL HOSPITAL CAMP PENDLETON CA	926	131
USMC	USMC	DISTRICT OF COLUMBIA	MARBKS WASHINGTON DC	489	48
USMC	USMC	FLORIDA	MCSF BLOUNT ISLAND	978	31
USMC	USMC	GEORGIA	MCLB ALBANY GA	6,995	265
USMC	USMC	HAWAII	MCB HAWAII KANEOHE	7,472	345
USMC	USMC	JAPAN	CATC CAMP FUJI JA	641	68
USMC	USMC	JAPAN	MCAS FUTENMA JA	2,059	125
USMC	USMC	JAPAN	MCAS IWAKUNI JA	10,913	983
USMC	USMC	JAPAN	MCB CAMP S D BUTLER OKINAWA JA	17,931	969
USMC	USMC	JAPAN	NAVAL HOSPITAL OKINAWA JA	760	143
USMC	USMC	LOUISIANA	MARFORRES NEW ORLEANS	1,895	126
USMC	USMC	NEW YORK	MARCORPS DIST 1 GARDEN CITY NY	174	31
USMC	USMC	NORTH CAROLINA	MCAS CHERRY POINT NC	6,747	761
USMC	USMC	NORTH CAROLINA	MCB CAMP LEJEUNE NC	27,385	2,011
USMC	USMC	NORTH CAROLINA	NAVAL HOSPITAL CAMP LEJEUNE NC	938	147
USMC	USMC	SOUTH CAROLINA	MARCORCRUITDEP PARRIS ISLAND SC	3,649	455
USMC	USMC	SOUTH CAROLINA	MCAS BEAUFORT SC	3,045	209
USMC	USMC	SOUTH KOREA	CAMP MUJUK REPUBLIC OF KOREA	292	30

Component	Command	State / Country	Installation Name	Gross Square Footage (Thou. SF)	Total Site Delivered Energy (BBtu)
USMC	USMC	VIRGINIA	MARINE CORPS BASE QUANTICO VA	7,762	876
WHS	WHS	MARYLAND	CHEVERLY WAREHOUSE	60	23
WHS	WHS	VIRGINIA	FLEET DISTRIBUTION CENTER	14	5
WHS	WHS	VIRGINIA	FOUNDER'S SQUARE	303	38
WHS	WHS	VIRGINIA	GUNSTON COMMERCE CENTER (BLDG. #5)	13	5
WHS	WHS	VIRGINIA	LEE BUSINESS CNTR	4	3
WHS	WHS	VIRGINIA	MARK CENTER	1,876	104
WHS	WHS	VIRGINIA	PARKRIDGE CENTER 2	86	24
WHS	WHS	VIRGINIA	WASHINGTON HQS SERVICE	6,931	902
WHS	WHS	VIRGINIA	XEROX WAREHOUSE	44	1

Appendix Q - References

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