THE UNDER SECRETARY OF DEFENSE
3010 DEFENSE PENTAGON
WASHINGTON, DC 20301-3010

ACQUISITION
AND SUSTAINMENT

FEB 25 2020

MEMORANDUM FOR ASSISTANT SECRETARY OF THE ARMY (INSTALLATIONS, ENERGY, AND ENVIRONMENT)
ASSISTANT SECRETARY OF THE NAVY (ENERGY, INSTALLATIONS, AND ENVIRONMENT)
ASSISTANT SECRETARY OF THE AIR FORCE (INSTALLATIONS, ENVIRONMENT, AND ENERGY)
DIRECTORS OF THE DEFENSE AGENCIES
DIRECTORS OF THE DOD FIELD ACTIVITIES

SUBJECT: Metrics and Standards for Energy Resilience at Military Installations

This memorandum implements the requirements of title 10, United States Code, section 2911(a), by establishing metrics and standards for the assessment of energy resilience pursuant to section 2911(b)(1). The purpose of these metrics and standards is to ensure the energy resilience of Department of Defense (DoD) military installations. It fulfills, in part, the responsibility of the Secretary under section 2911.

As discussed in the *2018 National Defense Strategy*, the variety and velocity of global threats continues to rapidly evolve. The homeland is no longer a sanctuary, and we must anticipate potential attacks and mitigate risks to our critical defense, government, and economic infrastructure. In this environment, maintaining secure access to energy resources is critical to the Department's execution of its mission, and ensuring energy resilience at our installations is a top priority.

DoD Instruction 4170.11, "Installation Energy Management," requires DoD Components to take necessary steps to plan and have the capability to ensure available, reliable, and quality power to continuously accomplish critical DoD missions from our installations. To that end, the attachment to this memorandum provides metrics, standards, supporting policy and guidance, and identifies associated reporting requirements. This memorandum and its attachment apply to all permanent and enduring installations worldwide.

The provisions of this memorandum and its attachment will be incorporated into the relevant DoD issuances at their next revision. The DoD Components shall take immediate action to implement this memorandum and its attachment. My point of contact is Mr. Walter Ludwig, Office of the Deputy Assistant Secretary of Defense for Energy, at (571) 372-6859.

Ellen M. Lord

Attachment:
As stated

METRICS AND STANDARDS FOR ASSESSMENT OF ENERGY RESILIENCE, SUPPORTING POLICY AND GUIDANCE, AND ASSOCIATED REPORTING REQUIREMENTS

I. POLICY

It is DoD policy that:

- Pursuant to section 2911(a) of title 10, United States Code, the DoD Components shall plan and program for the provision of energy resilience and energy security for DoD installations.

- The DoD Components shall perform energy resilience assessments of energy systems for critical mission operations and supporting infrastructure in support of Mission Assurance objectives on all permanent and enduring installations.

II. METRICS AND STANDARDS.

The following requirements constitute the metrics and standards for developing energy resilience assessments:

- Planning and programming for energy resilience and energy security—
  - should promote the use of multiple and diverse sources of energy, with an emphasis favoring energy resources originating on the installation;
  - should promote the use of cyber-resilient microgrids to ensure the energy security and energy resilience of critical missions;
  - should favor the use of installed energy sources rather than emergency generation for short-duration (less than one hour) outages caused by events other than hostilities or terrorism;
  - shall include adequate sustainment resources to maintain real property investments and ensure safe operations and testing of energy infrastructure;
  - shall promote the regular maintenance, testing, and disruption prevention practices related to onsite energy systems, to include backup generators;
  - shall identify different time horizons for different phases of planning; and
  - shall base decisions on current analyses of mission needs.

- Planning and programming should identify each of the following for each DoD installation based on the installation's own determination using an operational risk management framework to assess hazard probability and severity:
  - The critical missions of and supported by the installation.
  - The energy requirements of those critical missions located on, or supported by, the installation.
  - The duration those energy requirements are likely to be needed in the event of a loss of power.
  - The current source of energy provided to those critical missions.
  - The duration that the currently provided energy would likely be available in the event of a loss of power, and documentation that those sources have been adjudicated and prioritized for use among dependent missions.

- Alternatives identified to provide necessary energy to critical missions in the event of a loss of power.
- Alternative means of executing the mission as needed.

- Energy resilience assessments shall utilize the information developed for planning and programming and apply the other metrics and standards provided in section III to determine whether the installation meets the standards and requirements established in DoD Instruction 4170.11 for energy resilience.

- Such assessments shall either demonstrate compliance with the standards and requirements or identify where, and under what circumstances, the installation's energy and power systems are not in compliance.

- Such assessments shall include blackstart testing of installation energy systems by completely separating from the primary source of power for periods designed to evaluate the ability of the installation to perform critical missions without such resources. Such tests may exclude, if technically feasible, housing areas, commissaries, and exchanges.

- At the installation level, DoD Components shall identify (1) any risks of noncompliance identified during the assessments, (2) the costs projected to remediate such risks, and (3) progress to remediate such risks.

III. DETAILED PROCEDURES FOR DEVELOPING ENERGY RESILIENCE ASSESSMENTS

The following constitute additional metrics and standards for developing energy resilience assessments:

A. Energy load requirements.

DoD Components shall clearly define, identify, and update critical energy requirements, in accordance with the Defense Critical Infrastructure (DCI) Level of Effort (LOE) Security Classification Guide (SCG) and Baseline Elements of Information for Mission Assurance, that align to critical mission operations in collaboration with tenants, mission owners, and operators of critical facilities on DoD installations. As part of critical energy requirement determinations, DoD Components shall calculate critical energy loads for critical mission operations on DoD installations that require a continuous supply of energy in the event of an energy disruption. Components can compute their critical energy loads through an engineering facility energy load analysis or from metering data. Load assessments should also include time derived requirements as appropriate to support mission changes in contingency situations. Critical energy requirements shall be reviewed and updated on an annual basis through the Annual Energy Management Resilience Report (AEMRR) reporting process. Unified Facilities Criteria (UFC) 3-540-01[1] provides definitions and design criteria to assist in the determination of critical energy loads and to conduct facility energy load analysis. The critical energy requirements and critical energy loads identified by DoD Components shall be used to

[1] UFC 3-540-01, *Engine-Driven Generator Systems for Backup Power Applications.*

prioritize energy generation systems, infrastructure, equipment, fuel, and testing to achieve energy resilience.

Metered data may be available in varying degrees of accuracy to construct critical energy load profiles. In the event that critical energy loads are centralized on a DoD installation (e.g., main feeder), an aggregate reading of critical loads can be used to determine the projected and actual (i.e., tested) requirements of the loads in island mode.

If metered data is unavailable or incomplete, energy load analysis procedures are provided within UFC and Institute of Electrical and Electronics Engineers (IEEE) guidance. For example, UFC 3-501-01[2] provides demand data tables in its Appendix D, which can be used to calculate an original basis of design. However, the energy load analysis conducted during the basis of design may not be sufficient to conduct load analysis when the installation is in island mode.

Energy load analysis for islanded operations should be conducted in accordance with IEEE 1547.4,[3] Clause 5. The energy load analysis should evaluate historical demand profiles in order to identify step loads, motor loads, and the projected and actual (i.e., tested) requirements in island mode. Additionally, it is important that energy load analysis be conducted for both grid-connected and island modes.

B. Energy availability calculation.

Availability refers to the ability of an item to perform its required function at a stated instant of time or over a stated period of time under combined aspects of its reliability, maintainability, and maintenance support.

Mission availability is measured as follows:

$$Mission\ Availability = \frac{Uptime}{Uptime + Downtime}$$

Uptime is the length of time the critical mission operation requires energy throughout the year, and downtime is the length of time the critical mission operation can tolerate before mission failure occurs. The uptime and downtime hours based on mission risk are metrics to help determine mission availability.

For modern critical facilities, the typical benchmark availability ranges from 99.999% ("five nines") to 99.9999% ("six nines"). Table 1 shows mission availability associated with different downtimes, assuming total mission time over the course of one year is 8,760 hours (24 hrs. x 365 days). In order to achieve five-nines level of availability, mission downtime cannot exceed approximately five minutes per year. For a six-nines level of availability, that number is approximately 30 seconds per year.

[2] UFC 3-501-01, *Electrical Engineering*.
[3] IEEE 1547.4, *Standard for Interconnecting Distributed Resources with Electric Power Systems*.

Table 1: Mission availability for different down times

Uptime (hrs)	Downtime (hrs)	Mission Availability (%)
8672.4	87.6	99%
8751.24	8.76	99.9%
8759.12	0.876	99.99%
8759.91	0.0876	99.999%
8759.99	0.00876	99.9999%

Table 2 provides details and describes the differences between reliability and mission availability.

Table 2: Utility reliability and mission availability comparison

Measurement Area	Metric / Measure/ Requirement
Utility Reliability	• System availability o Planned versus unplanned outages • Reliability response time • Condition assessment (life safety) • Inventory changes
Energy Resilience	Mission Availability* = $\frac{\text{Uptime}}{\text{Uptime + Downtime}}$ *** **This metric does not constitute a "system" availability metric; rather it should represent a mission requirement (critical load) that identifies an energy capability metric. Uptime and Downtime are measured at the critical energy load level vice the utility system level.*

Utility reliability directly impacts DoD installations, and mission success often hinges on reliable, resilient utility systems. It is important to note that system reliability is not the same as power quality with respect to electrical utilities. A sustained interruption or outage (i.e. loss of the utility supply) greater than five minutes is generally considered a reliability issue. However, outages of less than five minutes are more of a power quality concern and considered a momentary interruption or outage. It is crucial that the DoD capture sustained interruptions or outages as accurately as possible to aid in the identification of maintenance issues, reliability and proper protection of our utility infrastructure. Outage information as reported in the AEMRR data call should also be considered a metric for energy resilience at DoD installations.

C. Energy reliability.

Energy reliability refers to the ability of a component or system to perform required functions under stated conditions for a stated period of time. Institute of Electrical and Electronics Engineers (IEEE) Standard 3006.8-2018[4] contains reliability data for equipment used in power systems which can help inform reporting on mission availability. However, while reliability data for equipment is associated with system reliability metrics, system reliability metrics do not take into account mission-based risks. DoD installations shall consider mission-based risks in their downtime measures when developing critical energy requirements. Of

[4] IEEE Standard 3006.8-2018: *Recommended Practice for Analyzing Reliability Data for Equipment Used in Industrial and Commercial Power Systems*

special importance, the calculation of reliability will consider the volume over length of time required of supporting fuels; even the best infrastructure can only adequately address risk if the supporting fuel supply is both secure and available from both a cyber and physical perspective.

D. Energy generation systems, infrastructure, equipment, and fuel.

DoD Components shall identify, design, and install primary power and emergency energy generation systems, infrastructure, and equipment to support their critical energy requirements.

Energy resilience solutions are not limited to traditional standby or emergency generators. They can and should include integrated, distributed, or renewable energy sources; diversified or alternative fuel supplies; relocating missions to alternative locations; and upgrading, replacing, and maintaining current energy generation systems, infrastructure, and equipment on DoD installations. Alternative locations that require a continuous supply of energy in the event of an energy disruption or emergency shall also be subject to energy resilience requirements.

When selecting distributed or renewable energy systems and emergency generators for energy resilience, they shall be properly designed to have the ability to prepare for and recover from energy disruptions that degrade mission readiness. Their design should include automatic, cyber-resilient transfer switching, inverters, and blackstart capabilities to minimize energy resilience risks. DoD Components shall also determine fueling or storage requirements for the selected energy generation systems. DoD Components shall follow relevant UFCs for safe and cost effective designs of energy generation systems that minimize energy resilience risks when complying with requirements stated in this memorandum.

DoD Components shall ensure that primary power and emergency energy generation systems, infrastructure, equipment, and fuel that support their critical energy requirements receive the necessary maintenance. At a minimum, DoD Components shall maintain primary power and emergency generation systems according to their technical specifications and ensure that there is a trained operator assigned to maintain the energy generation system, infrastructure, equipment, and fuel. DoD Components shall ensure that trained operators have the appropriate credentials to operate unclassified and classified energy generation systems, infrastructure, equipment, and fuel. DoD Components shall also develop and update fueling plans and ensure fueling contracts are in place. DoD Components shall consult the Defense Logistics Agency (DLA) when determining their fueling requirements.

E. Testing.

DoD Components shall conduct full-scale and routine testing of emergency and standby energy generation systems, infrastructure, equipment, and fuel that support their critical energy requirements as outlined in DoD Instruction 4170.11, *Installation Energy Management*. A full-scale test includes operating all associated emergency and standby energy generation systems, infrastructure, equipment and fuel at full operational loads while completely separated from the primary source of power. DoD Components may also elect to substitute a blackstart test for a full-scale test. Routine tests include operating all associated emergency energy generation systems, infrastructure, equipment, and fuel at full operational load while still connected to the

primary source of power. Regular energy resilience planning and modeling should also be considered a useful, complimentary method for enhancing energy resilience posture.

F. Execution and implementation of energy resilience.

DoD Components shall perform periodic vulnerability assessments and audits to assess the risk of energy disruptions on their installations as outlined in this document, and implement remedial actions to remove unacceptable energy resilience risks. DoD Components shall also provide energy projects that align to energy resilience requirements during the planning, programming, budgeting, and execution process. All energy projects shall be evaluated based on life-cycle cost effectiveness or if they reduce unacceptable energy resilience risk. DoD Components shall include energy resilient generation systems, infrastructure, equipment, and fuel storage facilities as part of their real property inventory to include in facility sustainment model consideration of sustainment funding.

IV. ENERGY RESILIENCE REPORTING

A. Reporting.

Reporting shall be conducted for all permanent and enduring installations as part of the AEMRR data call. Reports will be included in the AEMRR and shall be submitted to the Office of the Secretary of Defense (OSD) through routine DoD Component AEMRR submissions. Detailed installation energy resilience information should be documented in Installation Energy Plans (IEPs) required by the Assistant Secretary of Defense for Energy, Installations, and Environment Memorandum: "*Installation Energy Plans – Energy Resilience and Cybersecurity Update and Expansion of the Requirement to All DoD Installations*," dated May 30, 2018.

DoD installations shall review and consider their real property inventory submissions for alignment to AEMRR reporting. DoD Components shall submit energy resilience investments into real property records to be considered for sustainment funding as part of facility sustainment model (FSM) resourcing considerations. For example, facility asset code (FAC) 8112 is for stand-by/emergency power. Other important FACs such as 8111 (electric power generation plant), 8113 (hydroelectric plant), 8114 (wind generation), and 8115 (photovoltaic generation) from the Real Property Classification System can be used to inform reporting. DoD installations should note that information and data must be reported into the real property inventory for consideration in the FSM and sustainment funding.

B. Protecting classified and controlled unclassified information (CUI).

To the maximum extent practicable, DoD Components should work to submit unclassified information and data. Section 2925(a) of Title 10, United States Code does provide the authority to submit classified information and data to the congressional defense committees. If DoD Components submit classified information or data, they shall coordinate the classified submission with their operations security manager and the OSD point of contact.

The submitting point of contact or office of primary responsibility shall ensure all energy resilience data and related information are properly marked and protected in accordance

with DCI SCG, DoD operations security directives, instructions, and manuals, including DoD Directive 5205.02E; DoD Instructions 3020.45, 5200.01, and 5230.24; and DoD Manual 5205.02-M.

DoD Instruction 5230.24 allows for limited distribution markings to protect information and technical data that provide insight into vulnerabilities of U.S. critical infrastructure, including DoD warfighting capabilities vital to national security that are otherwise not publicly available. DoD Components shall consider the appropriate uses of limited distribution markings on their submission in accordance with DoD security guidance.

There are five relevant categories of CUI data defined by the National Archives and Records Administration (NARA): Controlled Technical Information (CTI), Critical Infrastructure (CRIT), DoD Critical Infrastructure Security Information (DCRIT), Critical Energy Infrastructure Information (CEII), Physical Security (PHYS), and Protected Critical Infrastructure Information (PCII).

V. DEFINITIONS

In this attachment, the following definitions apply:

critical energy loads. Energy loads on DoD installations that require energy resilience and energy security as defined in section 101(e)(6) of title 10, United States Code.

critical energy requirements. Critical energy loads and other measures that ensure critical mission operations on DoD installations continue to operate in the event of a loss of power.

critical mission. Those aspects of the DoD installation's missions that are critical to successful performance of the strategic national defense mission as determined by the Service or Component.

DoD installation. 'DoD installation' has the same meaning as provided for 'military installation' in section 2801(c)(4) of title 10, United States Code.

enduring location. A geographic site designated by the DoD for strategic access and use to support U.S. security interests for the foreseeable future. The following types of sites are considered enduring for U.S. Government purposes: main operating bases (MOBs), forward operating sites (FOSs), and cooperative security locations (CSLs). All three types of locations may be composed of more than one distinct site.

energy. Electricity, natural gas, steam, chilled water, and heated water.

full-scale system testing. Operation of all associated emergency and standby energy generation systems, infrastructure, equipment and fuel at full operational loads while completely separated from the primary source of power.

integrated system test or blackstart test. The ability and process of restoring electrical power systems automatically in the event of a disruption utilizing on-site power generation independent

from the local grid or transmission network to ensure that all systems return to their normal operation condition under abnormal conditions.

permanent installation. 'Permanent installation' has the same meaning as provided for 'military installation' in section 2801(c)(4) of title 10, United States Code.

VI. POINTS OF CONTACT

A. Office of Deputy Assistant Secretary of Defense for Energy (ODASD(Energy)).

Points of Contact:

Mr. Walter Ludwig
571-372-6859
walter.s.ludwig.civ@mail.mil

Ms. Danielle Russo
703-614-9576
danielle.a.russo3.ctr@mail.mil

B. U.S. Army Corps of Engineers (USACE), Power Reliability Enhancement Program (PREP).

PREP provides electrical and mechanical engineering support to assess resiliency of critical power systems for command, control, communications, computer, intelligence, surveillance, and reconnaissance (C4ISR) facilities. PREP provides these services through direct funding for specific DoD organizations, and on a reimbursable basis for other critical facilities.

Engineering support includes data collection, testing, design analysis, and project planning activities, such as availability/reliability studies, condition assessments, conceptual designs, fault current/protection coordination/arc flash analyses (a.k.a. short-circuit studies) and development of scopes of work and cost estimates. PREP can also make connections with the contracting, design, and construction services provided by the USACE.

PREP maintains a reliability database of electrical and mechanical equipment, published in Army Technical Manual 5-698-5, National Fire Protection Association Recommended Practice for Electrical Equipment Maintenance 70B, and Institute of Electrical and Electronic Engineers Standard 3006.8-2018, Recommended Practice for Analyzing Reliability Data for Equipment Used in Industrial and Commercial Power Systems. These technical manuals are informed by PREP's analyses and subject matter experts who serve on several standards and criteria development committees.

Installations may contact PREP directly to request assistance.

Point of Contact:

Mr. Michael
Fox 703-704-
2758
Michael.D.Fox7.civ@mail.mil

C. U.S. Army Corps of Engineers (USACE), 249th Engineer Battalion (Prime Power).

The 249th Engineer Battalion (Prime Power) provides prime electrical power, power distribution, and technical expertise to specific theater missions including strategic sites. It provides comprehensive technical and subject matter expertise for the analysis, construction, testing, repair, and sustainment of electrical systems ranging between tactical and commercial power systems including critical infrastructure. Examples of the work provided are lightning protection testing and analysis, ground grid testing, substation maintenance, and electrical systems analysis for back-up generation. All work is conducted or analyzed against industry standards and best practices. The 249th provides these services through customer provided funding.

Installations may contact the 249th directly to request assistance.

Point of Contact:

249th Engineer Battalion (Prime Power) Operations
usarmy.belvoir.usace.list.249-eoc@mail.mil