Energy Resilience: An Imperative for a More Lethal, Agile and Strategically-Relevant Force

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It is increasingly clear that continental United States (CONUS)-based installations no longer provide sanctuary to U.S. military forces prior to their deployment. The global reach of hostile powers with cyber, space and physical capabilities can contest friendly rear areas as well as forward deployed forces.¹

The expanding battlespace includes CONUS-based command posts, critical supercomputing operations, intelligence, fusion and cyber assets used by a global force and the joint logistics and sustainment functions required to support multi-domain operations—all of which emanate from installations in the Strategic Support Area (SSA).² From an energy perspective, this blurs the distinction between installation energy and operational energy, suggesting that approaches to energy security at the tactical edge may be relevant to installations within the SSA.

Modernizing how the Department of Defense (DoD) generates, manages and consumes power impacts how the Army sustains operations from its installations and facilities in CONUS to the forward edge of distant battlefields. The U.S. Army—and the rest of DoD—needs to maintain focus on the issue of energy resilience to be a ready, lethal and modernized force.³

Strategic Context: The Shifting Character of War

The 2017 U.S. National Security Strategy (NSS) describes a world in which many actors have become “skilled at operating below the threshold of military conflict” and highlights vulnerabilities in U.S. critical infrastructure such as the electrical grid.⁴ The NSS states that America must “strengthen

its capabilities across numerous domains—including space and cyber—and revitalize capabilities that have been neglected.” It also calls for the United States to become an energy-dominant nation with energy initiatives that attract investment, safeguard the environment and strengthen security.\footnote{Ibid., p. 22.}


The evolving strategic context is driving what U.S. Army Chief of Staff, General Mark Milley, describes as an emerging “fundamental change in the character of war.” Technology, geopolitics and demographics are rapidly changing societies, economies and the tools of warfare, affecting why, how and where wars are fought—and who will fight them.

Milley sees that these shifts not only present challenges, but opportunities as well. “If we can anticipate or at least recognize [the shifts], we can adapt proactively, maintaining or regaining overmatch and forcing competitors to react to us. Missing these shifts, however, can have devastating consequences.”\footnote{Mark A Milley, “Chief of Staff of the Army: Changing Nature of War Won’t Change Our Purpose,” \textit{AUSA Headline News}, 1 October 2016, https://www.ausa.org/articles/changing-nature-war-wont-change-our-purpose.} The U.S. Army recognizes that these shifts are occurring not only on distant battlefields, but also at home.

\section*{Insights from Operational Energy}

Based on lessons from rapid prototyping and fielding of operational energy systems by the Army’s Rapid Equipping Force, the Army has begun to reevaluate the way it delivers power to the battlefield.\footnote{Department of Defense, 2016 \textit{Operational Energy Strategy}, p. 6, https://www.acq.osd.mil/eie/Downloads/GE/2016%20DoD%20Operational%20Energy%20Strategy%20WEBc.pdf.} Because fuel and energy are essential to operational and tactical effectiveness, the Army has spearheaded the field-testing of advanced power systems in support of deployed forces in Afghanistan, Africa and Central America.

Advanced power systems align supply with demand, using power available from grids, vehicles, generators and renewables to supply only the power necessary at the point of need. If a power source is disabled, other sources pick up the deficit and batteries balance the load. These systems combine mobility with renewable energy, battery storage and legacy systems (e.g.,

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\textit{“Soldier readiness starts at home on top quality Army installations.”} \\

\textbf{– General Mark A. Milley}

\section*{SECRETARY OF DEFENSE PRIORITIES FOR THE JOINT FORCE}

- Build a more lethal force;
- strengthen alliances and attract new partners; and
- reform the department for greater performance and affordability.

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vehicle charging and commercial and advanced mobile medium power source generators) to compensate for deficits in available power.

At the tactical edge, energy resilience is also being enhanced by multiple efforts, including:

- reduced demand through increased efficiency;
- multiple power generation sources, optimized for system outcomes;
- energy storage devices;
- intelligent, secure grids able to move power to key loads; and
- enhanced training.

These initiatives—resulting from the Army rethinking how it delivers power to the battlefield—offer insights to the situation facing CONUS installations and power projection platforms.

### From Factory to Fort to Foxhole—Installation Readiness is Operational Readiness

Installations serve as the initial maneuver platforms for projecting forces into a given theater and, once employed, for conducting operations. These installations—Strategic Readiness Platforms—consist of power projection, force mobilization capabilities and the critical infrastructure needed to:

- train, mobilize and deploy forces;
- project multi-domain capabilities; and
- provide materiel support for Combatant Command operations plans or contingency requirements to meet the NDS.¹⁰

“Warfighter readiness begins on Army installations, and, like it or not, Army installations are now part of the fight. Army doctrine, policies, and resourcing decisions will need to prepare to meet these challenges.”¹¹ This is critical because the Army must be able to operate with diverse partners to defend the homeland and mitigate the effects of attacks and disasters. It must deploy and project forces, conduct forcible and early entry and set conditions across multiple domains to rapidly transition to offensive operations to ensure access and seize the initiative. The Army must also set the theater, provide strategic agility to the joint force and maintain freedom of movement and action during sustained and high-tempo operations while at the end of extended lines of communication in austere environments.¹²

Installation energy security and resilience is foundational to ensuring the availability of operational energy for force generation and power

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As such, the Army is reinforcing DoD efforts to make energy resilience a foundational requirement. From modernization of its domestic power footprint in conjunction with local communities, pursuit of promising energy technology and enhancing agility and resilience of power projection and deployed forces, the Army is integrating new capabilities and changing business practices.

Although not directly articulated in the Army Warfighting Challenges (AWFCs), energy resilience is essential to addressing several Army capability gaps. These AWFCs include: conducting homeland operations; conducting joint expeditionary maneuver and entry operations; and setting the theater, sustaining operations and maintaining freedom of movement.

### DoD Reliance on Commercial Power

Among the vulnerabilities to the SSA is the dependence of many DoD installations upon the private sector and surrounding communities for commercial power. Cascading effects of power disruption, extending to communications and water infrastructure, have the potential to inhibit the ability to project power, conduct operations in the SSA and support forward deployed forces.

The vulnerabilities of power sources beyond the installation are significant. Most of the power moving throughout the various utilities that operate the U.S. grid is sourced through a handful of critical points in the transmission and distribution system. A January 2017 U.S. Department of Energy report to Congress assessed that:

DoD’s reliance on commercial power presents many of the same challenges faced by all electricity customers: the transmission system is highly-vulnerable to weather-related damage, natural disasters such as earthquakes and physical attacks; electricity substations are vulnerable to cyber and physical attacks, as well as to geomagnetic storms; the distribution system is highly-vulnerable to weather and natural disasters; and controls centers are vulnerable to cyber and physical attacks.

### The Way Forward

#### Public-Private Partnerships

The Army has introduced diverse power production sources to more than a dozen CONUS-based installations. (Most utility scale renewable energy generation is “grid-tied,” meaning that if the grid distribution or transmission systems are disrupted, alternative power sources will not work unless designed for off-grid or islanded capability.) For example, in May 2018, the Army began operations of a 50-megawatt, multifuel power plant at

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13 Surash, “Multi-Domain Battle: Challenges for Army Energy.”

Schofield Barracks, Hawaii. The first of its kind on any Army installation, the Army provided the land upon which Hawaiian Electric Co. built the plant and will run it for the Army. In the event of a prolonged disruption, the base, plus Wheeler Army Airfield and the local hospital, will be able to continue operating off the grid for 30 days.\textsuperscript{15}

In 2015, Fort Drum also tested the off-grid concept, disconnecting from the national grid and powering all installation operations from a biomass plant. This demonstration of resilience and self-sufficiency was an important step toward installation modernization for the emerging operational environment.

**Energy Resilience: A Critical Enabler for Readiness and Modernization**

The U.S. Army has embarked on its most significant modernization campaign since the “Big Five” acquisitions of the 1970s that were informed by insights from the 1973 Yom Kippur War and the build-up of Warsaw Pact forces in Western Europe. The Army modernization plan announced in October 2017 is informed by lessons from the Russian invasion of Ukraine in 2014 and has led to the establishment of U.S. Army Futures Command to provide a focus on its top priorities.

The modernized systems under development will require uninterrupted, resilient advanced power from home station to the battlefield at all echelons. Science and technology investment in the right concepts is necessary for effective modernization. Increased command, control, communications, computer, intelligence, surveillance and reconnaissance capabilities and enhanced movement and maneuver require power and energy as critical enablers. The Army needs to account for power and energy as part of the development of new capabilities to preclude unforeseen sustainment issues that may impact force effectiveness for decades.\textsuperscript{16}

**Increasing Installation Readiness and Resilience**

Prolonged budget constraints have adversely affected installation readiness and resilience. For the Army to train as it will fight, and become a more ready and lethal force, energy resilient installations are essential. Therefore, the Army needs a value equation for resiliency efforts that enables key projects to effectively compete for resources and private financing mechanisms.

The emerging challenges of the operating environment necessitate investments in resiliency initiatives including vehicle-to-grid and tactical microgrids, while enhancing and leveraging talents which can utilize agile acquisition methods that assign value to resiliency efforts.

The DoD Operational Energy Strategy emphasizes that training should reflect the reality of the increased risks to U.S.-based operations. It also


stresses that war-gaming, modeling and simulation tools, along with focused analyses, should be exercised jointly when enhancing readiness at home.17

Potential adversaries have ready access to technologies and techniques that allow them to delay mobilization, disrupt deployments, interfere with operations, undermine morale and create friction between installations and surrounding communities. Army doctrine, policies and resourcing decisions should prepare to meet these challenges.18

Advanced functionalities that can come from tactical microgrids and vehicle-to-grid (VTG) efforts can support deployed combat forces, humanitarian assistance and disaster relief efforts, cooperative security engagements and CONUS training.19 Envisioned future capabilities include on-demand microgrids that use a combination of platforms including ground generators and tactical vehicles as well as the ability for grid segmentation and silent watch.20 Both in CONUS and deployed overseas, tactical microgrids can relieve pressure on the national grid in a crisis.

To address these challenges, it is necessary to leverage expertise in academia as well as in the commercial and financial sectors. These are not just engineering challenges—they require strategic collaboration with installation management, training and doctrine, policy and acquisition, logistics and sustainment as well as the financial and project development communities.

Enhanced use of rapid and agile acquisition models—adaptable for evolving concept of operations—are foundational to meeting modern energy challenges. Being fixated solely on the requirement limits the ability to rapidly adjust to new realities. Adopting rapid acquisition models not only saves time and tax-payer dollars, but often delivers superior capabilities.

**Recommendations**

- Enhance efforts to articulate the contribution of energy resilience to the military value of installations, their critical infrastructure and lethality of the force.

- Develop a continuous power mindset, extending from modernization and development to CONUS installations to deployed forces—across all echelons.

- Assign a cost-value equation to resilience-hardening.

- Rehearse contingencies pertaining to attacks on critical infrastructure in the strategic support area.

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20 Ibid., p. 7.
• Fund integrated advanced power solutions such as VTG and tactical microgrids, enabled by talent development and the use of agile and rapid acquisition methods.
• Pursue collaboration with industry and academia in support of a national energy security strategy.

## Conclusion

A resilient energy infrastructure enterprise can provide assured access to critical power for the installations where Soldiers train, from which they mobilize and deploy, and wherever they are employed in pursuit of national military objectives. This will be essential to DoD’s realization of its top priorities of increasing readiness and lethality.

The U.S. Army—and DoD—must increase focus on energy resilience to remain operationally relevant in the emerging threat environment. Without this foundational critical enabler, it risks the accomplishment of its mission, both domestically and overseas.

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• In Fiscal Year 2018, with funding from Congress, Norwich established CGRS to provide research and education on new power technologies for use in expeditionary operations and Army facilities alike.
• CGRS’s goal is to educate toward a mindset focused on efficiency, optimization and smarter logistics in development of the Army’s next generation of civil engineers.

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