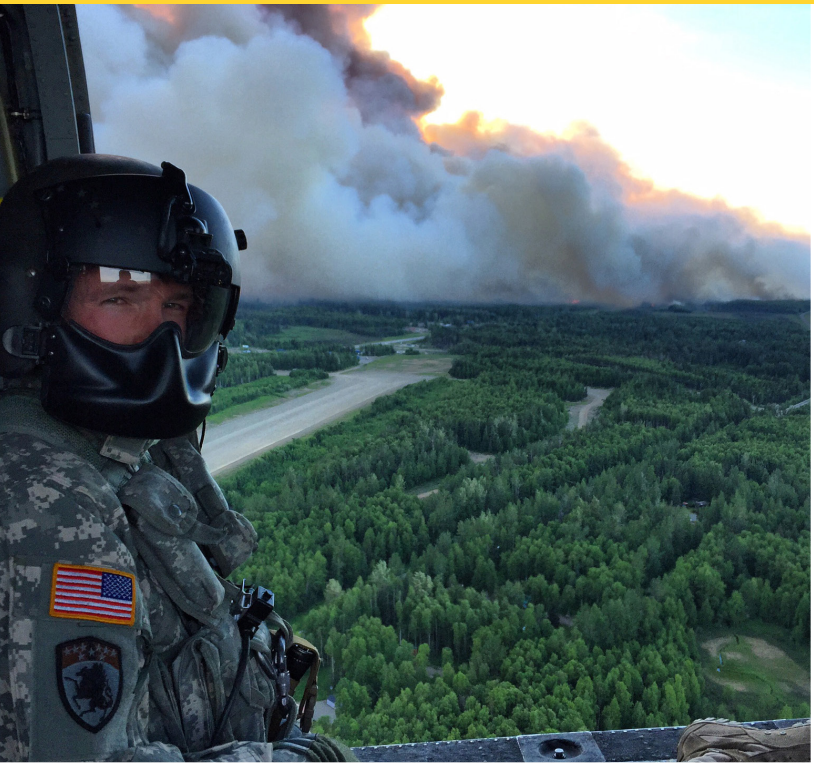
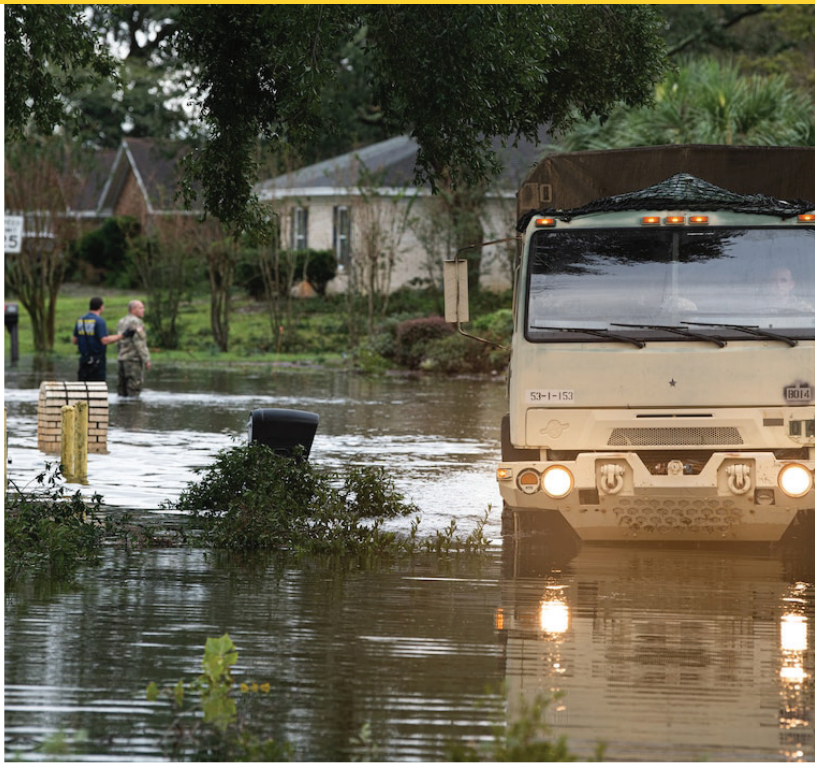
UNITED STATES ARMY

Climate Strategy





U.S.ARMY

KEY TERMS USED THROUGHOUT THIS STRATEGY

Climate Change: Variations in average weather conditions that persist over multiple decades or longer that encompass increases and decreases in temperature, shifts in precipitation, and changing risk of certain types of severe weather events.

Adaptation: Adjustment in natural or human systems in anticipation of or response to a changing environment in a way that effectively uses beneficial opportunities or reduces negative efforts.

Mitigation: (specific to climate change) Measures to reduce the amount and speed of future climate change by reducing emissions of heat-trapping gases or removing carbon dioxide from the atmosphere.

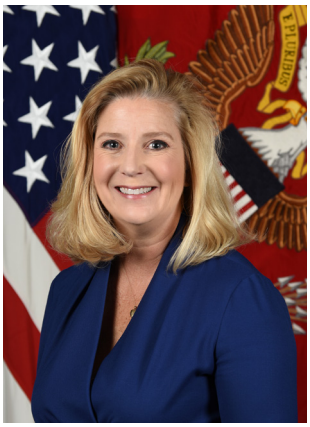
Resilience: The ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions.

PLEASE CITE THIS STRATEGY AS:

Department of the Army, Office of the Assistant Secretary of the Army for Installations, Energy and Environment. February 2022. United States Army Climate Strategy. Washington, DC.

Front cover: Top Left: The Alaska Army National Guard supports fire suppression efforts in and near Willow, Alaska, in June 2015. Top Right: Soldiers assist residents of Escambia County, Florida after heavy rain from Hurricane Sally flooded the region, Sept. 16, 2020. (Photo Credit: U.S. Air Force, Tech. Sgt. Christopher Milbrodt). Middle: Stock photo, desertification. Bottom: Stock photo, image of hurricane from space.

FOREWORD



Climate change threatens America's security and is altering the geostrategic landscape as we know it. For today's Soldiers operating in extreme temperature environments, fighting wildfires, and supporting hurricane recovery, climate change isn't a distant future, it is a reality.

The time to address climate change is now. The effects of climate change have taken a toll on supply chains, damaged our infrastructure, and increased risks to Army Soldiers and families due to natural disasters and extreme weather. The Army must adapt across our entire enterprise and purposefully pursue greenhouse gas mitigation strategies to reduce climate risks. If we do not take action now, across our installations, acquisition and logistics, and training, our options to mitigate these risks will become more constrained with each passing year.

The Army will lead by example. We will tap into the creativity, capabilities, and commitment of Army professionals operating on every continent. We will use our buying power to drive change in industry and leverage best practices from many sources. We will engage with local communities and foreign partners to ensure mutual readiness and security in a rapidly changing environment.

The Army is on track to build on the progress we've achieved to date and reach every aspect of the Army enterprise. As the Army invests in modernization, readiness, and operations, we can create the land forces that our nation needs today while securing a sustainable, cleaner tomorrow. As the Army optimizes the use of fuel, water, electricity, and other resources, we increase our resilience while saving taxpayer dollars and reducing our impact on the planet. The Army will mitigate and adapt to climate change, and in doing so gain a strategic advantage, especially as we continue to outpace our near-peer competitors.

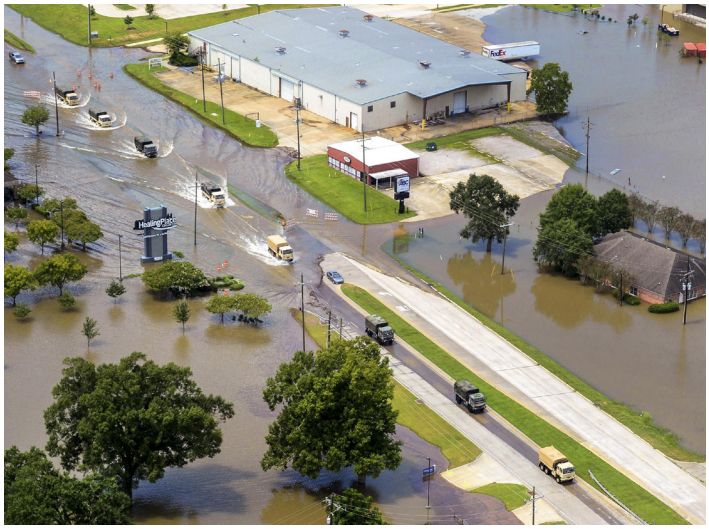
We have a unique opportunity to improve our defense capabilities and become a more efficient force, while securing a better future. I challenge our Army to examine climate threats, prioritize resources, and take swift action.

Christine E. Wormuth
Secretary of the Army

ARMY CLIMATE STRATEGY

Climate change endangers national and economic security, and the health and well-being of the American people. The risks associated with climate change are broad, significant, and urgent. These risks will impact the Army at all levels: from how and where units operate and train, to how the service as a whole equips and sustains Soldiers to fight in multi-domain operations.

> "We face all kinds of threats in our line of work, but few of them truly deserve to be called existential. The climate crisis does. … Climate change is making the world more unsafe and we need to act."
>
> – *Secretary of Defense*



Army tactical vehicles transport flood relief supplies along a highway in Denham Springs, Louisiana after more than 30 inches of rainfall caused severe flooding in southeast portions of the state. The Soldiers and vehicles are assigned to the Louisiana Army National Guard, which mobilized more than 1,000 personnel to respond to the flooding. (Photo Credit: Army National Guard, 1st Sgt. Paul Meeker)

Through the Army Climate Strategy (ACS), the Army will continue to lead by example. **The Army's core purpose remains unchanged:** *to deploy, fight, and win the nation's wars by providing ready, prompt, and sustained land dominance as part of the Joint Force*. Climate change will only make this mission more challenging, and the Army must proactively reduce the risks that climate change imposes. The Army can increase capability and installations' resiliency; prepare for new hazards and new environments; modernize processes, standards, and infrastructure; and decrease operational energy demand—all of which in turn will reduce greenhouse gas (GHG) emissions.

Guided by the ACS, the Army will build on its current progress in areas such as vehicle fuel efficiency and electrification, operational power generation, battery storage, land management, procurement, supply chain resilience, and workforce development. The Army will continue to reduce consumption of energy and other natural resources to improve operational readiness and modernization while adapting to and mitigating current and future climate threats.

Climate Threats and Risks

The world is already experiencing the compounding effects of climate change. Immediate hazards associated with climate change include higher temperatures; changing precipitation patterns; and more frequent, intense, and unpredictable extreme weather. These climate hazards will alter natural and social systems through primary and secondary impacts, leading to security implications for the Army.[1]

Consider changing rainfall patterns, for example. As GHG emissions increase global average temperatures, scientists have observed several primary impacts of this hazard—in particular, more and worsening droughts in some regions while other regions experience more frequent and severe flooding. As a result, some regions of the world will have less access to water supplies, while others will be subjected to widespread and prolonged inundation. This situation presents opposing challenges, but both conditions will increase competition for scarce resources and demand for humanitarian aid and disaster response. The Army will face simultaneous readiness challenges as units contend with limited access at flooded bases, alongside increased water scarcity and land degradation in other areas.

The secondary impacts of climate hazards could be even more dangerous. Chief among them is an increased risk of armed conflict in places where established social orders and populations are disrupted. The risk will rise even more where climate effects compound social instability,

[1] Adapted from: Department of Defense Climate Risk Analysis. Report submitted to the National Security Council, October 2021.

reduce access to basic necessities, undermine fragile governments and economies, damage vital infrastructure, and lower agricultural production. Adversaries and other malign actors may seize dwindling resources while seeking new opportunities to threaten U.S. national interests. Taken together, climate hazards will result in less economic and social stability, fewer goods to meet basic needs, and a less secure world.

The Army must remain ahead of adversaries seeking strategic positional advantages in a climate-altered world. For example, the Arctic is warming twice as fast on average as the rest of the world, and disappearing sea ice is opening new trade routes and access to new natural resources, inviting greater strategic competition. In regions across the globe, these changes foreshadow the demanding environmental conditions in which Army forces must be prepared to operate.

For the foreseeable future, climate impacts will disrupt Army activities, displace individuals and communities, and increase the frequency of crisis deployments. The Army must prepare for potential consequences including energy and water scarcity; damage to installations and infrastructure; displacement of and disruptions to operations, supply chains, and logistics; and imperiled Soldier health through exposure to airborne irritants like smoke and dust, disease vectors, and temperature extremes. In addition, the land on which the Army trains and operates may be altered, limited, or constrained. The Army must act decisively and urgently to address the risks associated with all these effects.

Army Climate Goals and Execution of the ACS

Executive Orders (EO) 14008 and 14057 instruct the U.S. government to work deliberately to put the world on a sustainable climate pathway, build resilience both at home and abroad, and catalyze beneficial private sector investment.[2] Starting from the policies and directives in the EOs, the Army will pursue three major goals to reach the ACS end state (see box). Initiatives throughout the ACS contribute to multiple government-wide EO targets including reduced pollution from multiple sources, net-zero installations, sustainable procurement, increasing energy and water efficiency, and building resilience against the impacts of climate change.[3]

ACS END STATE AND GOALS

The Army will be a resilient and sustainable land force able to operate in all domains with effective mitigation and adaptation measures against the key effects of climate change, consistent with Army modernization efforts.

- **Achieve 50% reduction in Army net GHG pollution by 2030,** compared to 2005 levels
- **Attain net-zero Army GHG emissions by 2050**
- **Proactively consider the security implications of climate change in strategy, planning, acquisition, supply chain, and programming documents and processes**

To advance these goals and achieve Army-wide unity of effort against climate change threats, **the ACS establishes three Lines of Effort** (LOE). **LOE 1: Installations** will *enhance resilience and sustainability by adapting infrastructure and natural environments to climate change risks, securing access to training and testing lands into the future, and mitigating GHG emissions*. **LOE 2: Acquisition & Logistics** will *increase operational capability while reducing sustainment demand and strengthening climate resilience*. Finally, **LOE 3: Training** will *prepare a force that is ready to operate in a climate-altered world*.

Implementing this strategy requires input from two important enabling enterprises that span all ACS LOEs. The first is Army modernization, the enterprise that will create and deliver technological solutions to problems not only within each LOE, but spanning multiple LOEs as well. The second enabler is the Army's research, development, test, and evaluation (RDTE) enterprise, which will both refine the requirements that drive technical solutions and combine technologies into effective systems that can be applied in the real world. Because of their cross-cutting nature and broad perspective, RDTE experts and modernization stakeholders must participate early and often in every ACS LOE.

The Assistant Secretary of the Army for Installations, Energy and Environment is the proponent for this strategy, and will approve an Army Climate Action Plan to guide implementation through specific actions across the Total Army: all components, Army Commands, Army Service Component Commands, and Direct Reporting Units.

[2] Executive Order 14008, Section 101; Executive Order 14057, Section 101.
[3] Executive Order 14008, Section 201; Executive Order 14057, Sections 202–206, 208, and 303.

LINE OF EFFORT 1: INSTALLATIONS	
STRATEGIC OUTCOME:	
Enhance resilience and sustainability by adapting infrastructure and natural environments to climate change risks, securing access to training and testing lands into the future, and mitigating GHG emissions	
INTERMEDIATE OBJECTIVES:	
1.1	Install a microgrid on every installation by 2035
1.2	Achieve on-site carbon pollution-free power generation for Army critical missions on all installations by 2040
1.3	Provide 100% carbon-pollution-free electricity for Army installations' needs by 2030
1.4	Implement installation-wide building control systems by 2028
1.5	Achieve 50% reduction in GHG emissions from all Army buildings by 2032, from a 2005 baseline
1.6	Attain net-zero GHG emissions from Army installations by 2045
1.7	Field an all-electric light-duty non-tactical vehicle fleet by 2027
1.8	Field an all-electric non-tactical vehicle fleet by 2035
1.9	Continue to advocate for an expanded Army Compatible Use Buffer
1.10	Include climate change threat mitigation into Army land management decisions
1.11	Incorporate the latest climate and environmental science into stationing, construction, and fielding decisions

LINE OF EFFORT 1: INSTALLATIONS

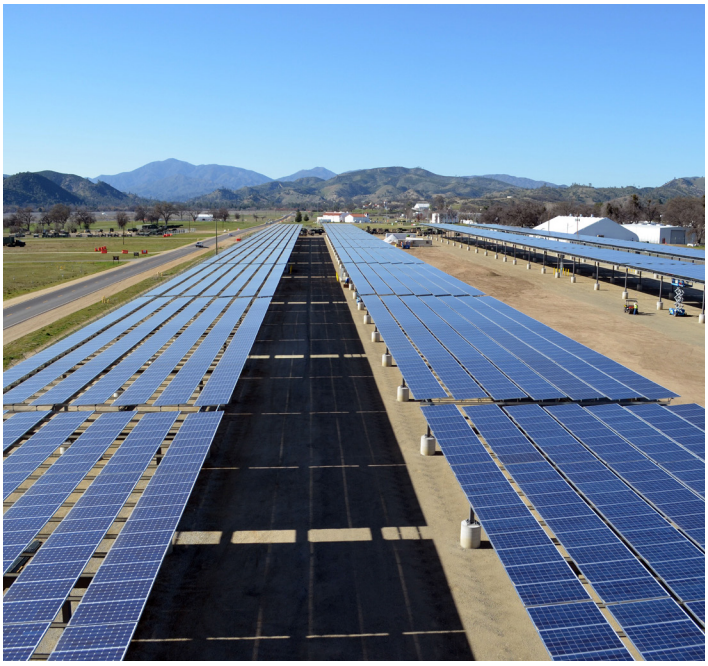
There are over 130 Army installations around the world that protect, support, and enable the force. They are the points where modernization and readiness efforts converge to create the trained and capable forces needed during crisis and conflict. Because of the systems and people they host, the communities they connect with, and the spaces they safeguard, installations anchor and guide some of the Army's most consequential efforts to improve itself while responding to climate change. Installation Senior Commanders are the Total Army leaders responsible for executing this LOE at the local level.[4]

As the Army evolves, leaders and units will take action on and through their installations to **enhance resilience and sustainability by adapting infrastructure and natural environments to climate change risks, securing access to training and testing lands into the future, and mitigating GHG emissions**. To these ends, the Army will pursue several related tracks, including *resilient energy and water supply, carbon-pollution-free electricity, efficient structures, non-tactical fleet electrification, land management, and enhanced planning*.

Resilient Energy and Water Supply

The Army must have resilient energy and water supply to complete its missions under all conditions. Because natural, physical, and cyber threats vary by location, the Army tailors its resilience investments to meet the circumstances of each installation. In the last five years

[4] Army Senior Commanders exercise command of Army installations. This is a direct delegation of the Secretary of the Army's command authority for the installation to the Senior Commander. See the Glossary.



Solar panel arrays form a canopy at a construction site in Fort Hunter Liggett, California. The construction site is for phase one and two of a solar microgrid project at the installation, managed by the U.S. Army Corps of Engineers Sacramento District. Along with energy production, the panel arrays provide shade for the majority of the post's vehicles. Fort Hunter Liggett is one of six pilot installations selected by the U.S. Army to be net zero energy, meaning the installation will create as much energy as it uses. (Photo Credit: U.S. Army, John Prettyman)

alone, the Army enhanced installation-wide resilience by bringing systems online such as Fort Irwin's water treatment plant upgrade, Fort Knox's 2.1-megawatt solar field, and Fort Carson's 8.5-megawatt-hour lithium battery. There are 950 renewable energy projects supplying 480 megawatts of power to the Army today and 25 microgrid projects scoped and planned through 2024. The Army will continue these and other efforts under the Army Installation Energy and Water Strategic Plan to maximize resilience, efficiency, and affordability on every installation. In collaboration with adjacent communities and stakeholders, the Army and its partners will invest across all its installations in onsite, backup renewable generation; large-scale battery storage; microgrids; and utility systems updated to current industry standards.[5] The Army will install a microgrid on every installation by 2035. The Army will also pursue enough renewable energy generation and battery storage capacity to self-sustain its critical missions on all its installations by 2040. Because of their role in critical defense missions and preparing and deploying forces, Mission Assurance Installations, Mobilization Force Generation Installations, and Power Projection Platforms will have priority for energy and water resilience projects.

Carbon-Pollution-Free Electricity

The Army purchases over $740M of electricity from the national electric grid every year. In 2020, this electricity added 4.1 million metric tons of carbon dioxide as well as methane, nitrous oxide, and other GHGs into the atmosphere. While the Army has decreased overall installation GHG emissions by 20% since 2008, the service can do more to incentivize greening the grid. Going forward, the Army will actively pursue carbon-pollution-free electricity production and storage to and on its installations. The Army looks to its real property assets to continue providing space for new renewable energy projects that both reduce GHG emissions and increase energy resilience. In collaboration with other Department of Defense (DoD) components, the Army will also pursue opportunities to encourage the national electric grid's transition by purchasing electricity from carbon-pollution-free generation sources. The Army is committed to 100% carbon-pollution-free electricity to meet the needs of its installations by 2030.

Efficient Structures

Increasingly efficient structures conserve Army resources, enable flexibility in resource allocation, and reduce operating costs. The Army has been a member of the U.S. Green Building Council (USGBC) since 2001, and has so far received USGBC's Leadership in Energy and Environmental Design (LEED) certification on 1,041 facilities. LEED is a globally recognized set of standards for sustainable, efficient, and cost-conscious buildings, developments, and communities that covers every aspect of construction and operation from architectural details to user mobility, construction techniques, and building materials. There are more than 65 million square feet of LEED-certified facility space in the Army's inventory within the United States as well as on Army installations in Germany, Japan, and South Korea. The Total Army will continue to expand its LEED-certified footprint by seeking the latest LEED Silver certification as a minimum standard for all new construction and major renovations and by exploring opportunities for more LEED Platinum certifications—the system's highest level. The Army will also modernize its installation workforce to ensure they have the training and expertise needed to maintain facilities to LEED standards. The Army has also pursued efficiency gains at smaller scale, like replacing energy-

[5] Local electrical systems that can manage multiple generation sources and loads and disconnect from the regular power grid to operate independently. See the Glossary.

intensive bulbs with light-emitting diodes (LED) and upgrading existing wastewater treatment systems to add water reclamation capability. Consistent with the Army Installation Energy and Water Strategic Plan, the Army is pursuing installation-wide building control systems by 2028. By bringing these and associated efforts together, all Army buildings will achieve 50% reductions in GHG emissions by 2032 from a 2005 baseline, and by 2045 the Army will have a net-zero emissions installations portfolio. These efforts will enable the Army to maintain its effectiveness while keeping overall resource consumption and costs as low as is practical.

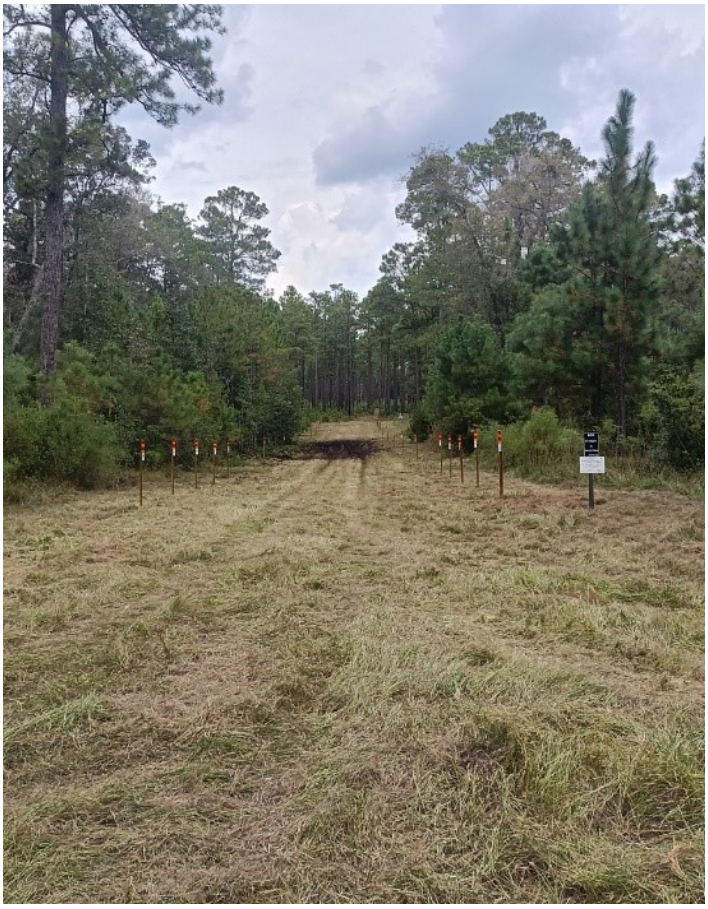
Non-Tactical Fleet Electrification

Throughout the global economy, motor vehicle technology is progressing rapidly. The Army can take advantage of this progress while modernizing its non-tactical vehicle (NTV) fleet, which includes commercially available vehicles such as sedans, station wagons, utility vehicles, trucks, vans, and buses. Cutting NTV GHG emissions to zero is an important component of reaching the Army's net-zero goal. Efforts to use less fossil fuel in the Army's NTV fleet and realize the associated operating cost savings have been ongoing since 2005. Through the end of 2020, the Army had removed 18,000 NTVs from its fleet while increasing its inventory of hybrid vehicles by almost 3,000 in the last 3 years alone.[6] These changes have already decreased NTV fleet costs by over $50 million, slashed Army fossil fuel consumption by more than 13 million gallons per year, and reduced the service's GHG emissions per mile by over 12%. The Army is continuing its transition to zero-emissions vehicles today, enabled by new policies like Army Materiel Command's (AMC) September 2021 mandate that all new vehicle leases, lease renewals, and purchases for AMC missions must select all-electric NTVs first, hybrids when electric solutions are not commercially available, and conventional gas vehicles by exception only. Steps like this are keeping the Army on track to field an all-electric light-duty NTV fleet by 2027, and use hybrid options as a bridging solution to field an all-electric Army NTV fleet by 2035.[7] However, fleet electrification will not be possible without the associated charging infrastructure. In 2022, the Army will invest in over 470 charging stations. All garrison commanders will work with industry and utility suppliers to determine how best to expand electric vehicle charging infrastructure on every Army installation. Recent electric vehicle pilot programs at Fort Benning and Fort Irwin demonstrate the way ahead to additional charging system investments across all Army installations in the coming years. To reduce costs, better leverage third party financing, and promote the adoption of electric vehicles throughout the Joint Force, the Army will explore potential partnerships with the Air Force and the Navy to jointly create a charging network on all DoD installations.

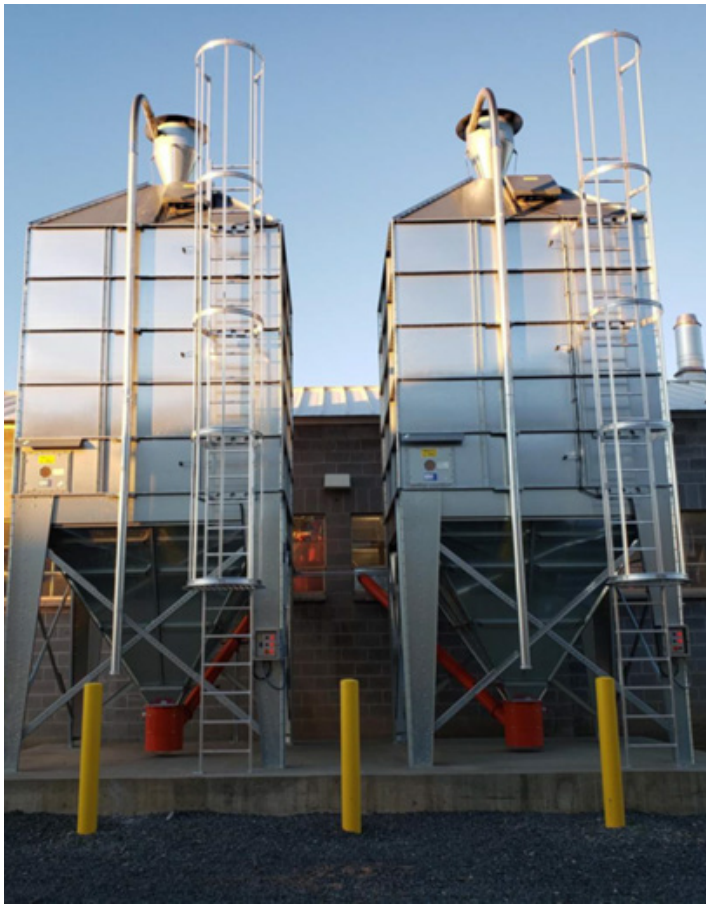
Land Management

Army land management and conservation are foundational to Army carbon sequestration. The Army manages over 13 million acres of land around the world. Senior Commanders rely on land management and conservation to preserve local environments in compliance with laws and regulations while maintaining access for training, testing, and mission requirements. Stewardship of Army lands can also help mitigate climate change threats by safeguarding forests and other beneficial environments alongside Army RDTE and training. Investments in land and ecosystem management for future access include programs such as the Army Compatible Use Buffer (ACUB) program, a voluntary system of local partnerships that preserves private land adjacent to Army installations, creating buffers that enhance physical security while also maintaining land in its natural state. The ACUB protects about 420,000 acres of privately owned lands. Camp Shelby, Mississippi, recently used ACUB to sequester the equivalent of 120,000 metric tons of carbon dioxide annually, or roughly 2,500 average households' carbon emissions every year. In addition to its immediate environmental benefits, the ACUB program also limits encroachment from incompatible development near installations, improves relationships between the Army and local populations, and increases safety stand-off distances for training areas. With so many concurrent benefits from one program, the Army must continue to advocate for and expand ACUB alongside continued access to lands and ranges. In addition, Senior Commanders bear important responsibilities for properly caring for and protecting designated habitats, ecosystems, and species. The Integrated Training Area Management (ITAM) program supports Senior Commanders and installation managers by optimizing decisions to repair, reconfigure,

[6] See the Glossary for expanded definitions of non-tactical and hybrid vehicles.
[7] "Light-duty" as used in the ACS refers to passenger cars, minivans, passenger vans, and pickup trucks and sport-utility vehicles under 8,500 pounds Gross Vehicle Weight Rating. Source: U.S. Environmental Protection Agency (EPA).



Integrated Training Area Management-constructed low water crossings are sustainable structures which facilitate maneuver through wetlands without precipitating erosion or obstructing the natural course of water. Fort Stewart, Georgia. (Photo Credit: U.S. Army)



This Centralized Biomass Pellet Silo in Umatilla, Oregon, is an Oregon Army National Guard renewable energy project with a resiliency component which uses biomass from local forests for heating several buildings. (Photo Credit: U.S. Army)

and maintain sustainable maneuver training areas. As a result, ITAM supports resilient bases, while ensuring spaces remain accessible to support Soldier training and mission requirements. Using ACUB, ITAM, and similar programs, land managers assist Senior Commanders in carrying out their responsibilities by managing soil, species, vegetation, coastlines, forests, wildland fire, waterways, wetlands, and watersheds using tools and techniques that account for climate change threat mitigation alongside Army and community needs.

Enhanced Planning

Army installations will use new tools, information, studies, and techniques for enhanced planning to precisely identify and correctly prioritize their operations, activities, and investments in light of expanding climate change threats. The Army is already considering climate resilience in master planning, natural resource planning, range management, and installation energy and water planning. The Army is also proactively implementing advanced planning tools, beginning with the Army Climate Assessment Tool (ACAT). Due to this tool's demonstrated ability to improve resilience, DoD has adopted and scaled ACAT as the Defense Climate Assessment Tool and is using it to prioritize highly exposed installations across DoD. Where Army modernization affects land use and facility changes, the Army must incorporate the latest climate and environmental science into stationing, construction, and fielding decisions. This will allow Senior Commanders and other decision-makers to understand the implications of land use, landscaping, and building design options early enough in the process to strike the appropriate balance between the infrastructure that a multi-domain, operations-capable, and ready Army needs and the effects that infrastructure could have on its environment and the climate. Army installation and range planning also depends heavily upon relationships with federal and state agencies, local communities, and other partners. The Army will continue to leverage its partners not only to inform installation adaptation and mitigation plans, but also as sources for useful innovations and assistance.

LINE OF EFFORT 2: ACQUISITION & LOGISTICS	
STRATEGIC OUTCOME:	
Increase operational capability while reducing sustainment demand and strengthening climate resilience	
INTERMEDIATE OBJECTIVES:	
2.1	Modernize existing Army platforms by adding mature electrification technologies
2.2	Field purpose-built hybrid-drive tactical vehicles by 2035 and fully electric tactical vehicles by 2050
2.3	Develop the charging capability to meet the needs of fully electric tactical vehicles by 2050
2.4	Develop predictive logistics that drive more precise and faster decisions
2.5	Establish policies that standardize contingency basing to increase resilience and reduce fuel requirements
2.6	Significantly reduce operational energy and water use by 2035
2.7	Achieve carbon-pollution free contingency basing by 2050
2.8	Adopt a Buy Clean policy for procurement of construction materials with lower embodied carbon emissions
2.9	Implement a revised energy key performance parameter
2.10	Attain net-zero GHG emissions from all Army procurements by 2050
2.11	Analyze all Army supply chain Tier 1 sources and contracts for climate change risks and vulnerabilities by 2025
2.12	Develop plans, policies, and contracts to ensure Army supply chain resilience by 2028

LINE OF EFFORT 2: ACQUISITION & LOGISTICS

Combat units deploy with large logistics formations that deliver, maintain, and sustain the combat power and bases needed to fight and win the nation's wars.[8] Enhanced operational capabilities are needed to gain future competitive advantage, and these capabilities will come in part from investment in a broad range of acquisition and logistics initiatives. When done correctly, such investments can also minimize certain Army GHG emissions and reduce the Army's climate impacts. In particular, the Army can better position itself for future conflict by more effectively deploying and staging combat power across the globe, optimizing supply and distribution networks, and creating flexibility for the Defense Industrial Base. In these and other ways, the Army will **increase operational capability while reducing sustainment demand and strengthening climate resilience**, and also reducing GHG emissions, cost, and risk. The Army sees great promise for sustainment demand reduction through advanced technology, future contingency basing, clean procurement, and resilient supply chains.

Advanced Technology

Tactical self-sufficiency supports independent, distributed, and echeloned maneuver, which will be essential in

[8] In this strategy and the Army Doctrine Publication 4-0, "logistics" refers to the maintenance, transportation, supply, field services, distribution, operational contract support, and general engineering support aspects of Army sustainment.

future contested environments. Reducing energy requirements and overall demands on Army distribution networks are two broad approaches that contribute to tactical self-sufficiency. Along those lines, advanced vehicle technology, more effective power solutions, alternative water sources, advancements in manufacturing, autonomous re-supply, next-generation material and packaging, and other new technologies and modernization efforts will reduce demand, increase combat effectiveness, and reduce GHG emissions.

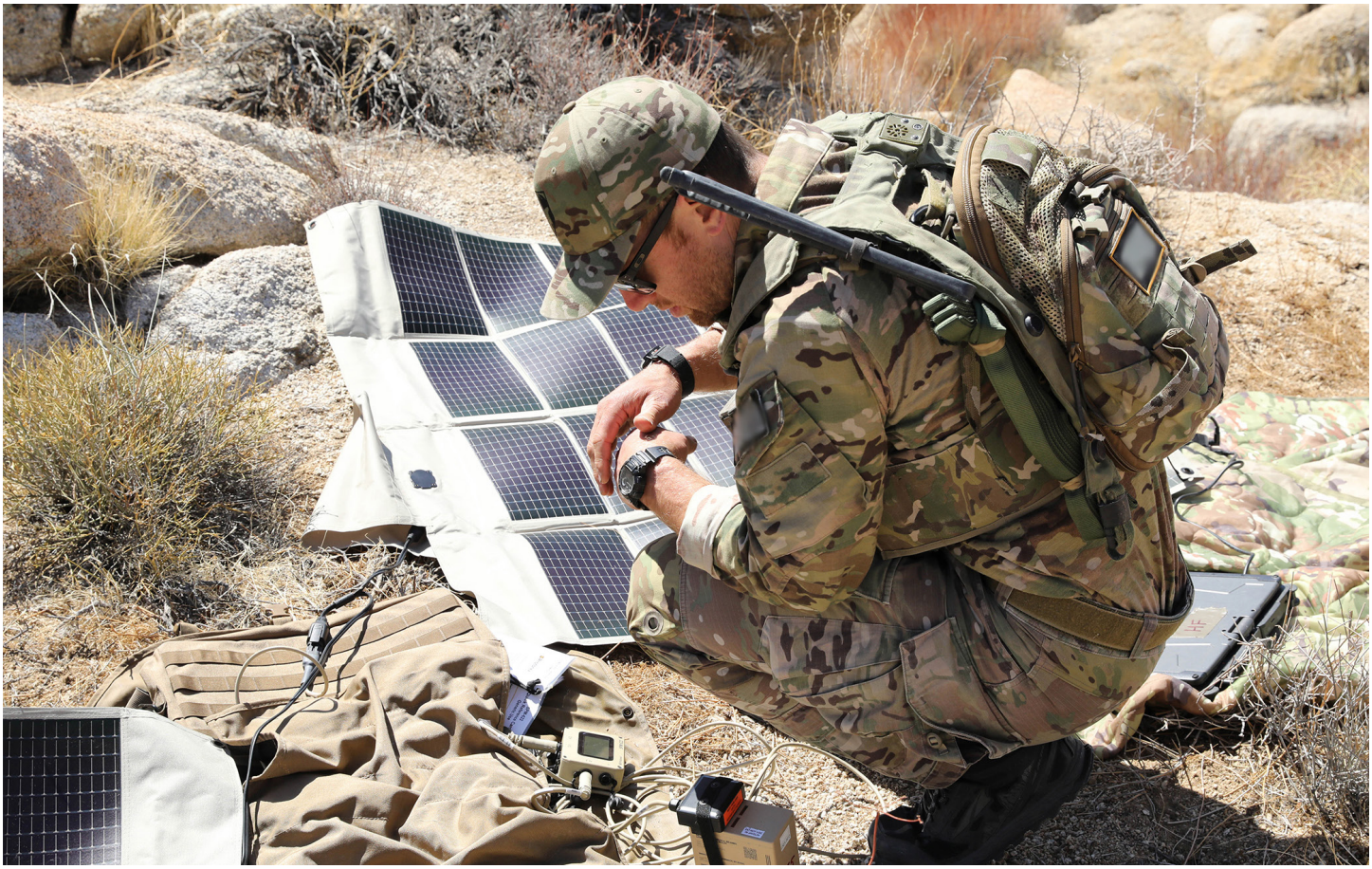
A significant portion of the Army's sustainment demand comes from its fleet of tactical vehicles, including everything from light reconnaissance platforms to heavy transport trucks, and everything in between. The Army has been working to reduce the fossil fuel consumption of its vehicle fleets for many years, and recent gains are encouraging. For example, the Army is demonstrating Tactical Vehicle Electrification Kits (TVEK) on numerous tactical platforms, reducing average fuel consumption by approximately 25% while providing more on-board electric output per application. One extra benefit of TVEK is "anti-idle," a ground vehicle capability that shuts off a vehicle's engine during halts, while still providing power to vehicle accessories. Contemporary Army ground vehicles must continuously run their engines non-stop to power vital auxiliary systems like communications equipment even when the vehicle is not moving. Introducing anti-idle enables these systems to be powered even with the engine off, allowing the vehicle to serve its critical battlefield functions on "silent watch." This improved capability not only makes Army units harder for adversaries to find by lowering their thermal and acoustic signatures, these technologies also reduce fuel consumption and lower Army GHG emissions. To capitalize on the simultaneous combat and climate benefits of "silent watch," the Army will continue to modernize its existing platforms by adding mature electrification technologies like TVEK and anti-idle.

In the mid-term, the Army is using a robust network of partnerships in RDTE to develop promising technologies. The first prototype of an Electric Light Reconnaissance Vehicle (eLRV) is expected to enter testing before September 2023. Meanwhile, the Army is researching key questions about hybrid vehicle propulsion and power generation systems, developing advanced technologies, and working with vehicle Program Managers to integrate hybrid electric technologies into future and existing platforms. As a result, the Army will field purpose-built hybrid-drive tactical vehicles by 2035 and fully electric tactical vehicles by 2050.

Although fully electric tactical vehicles are still years into the future, the Army is already working on recharging capabilities for contingency operations. As one part of this approach, Army Futures Command, Army Materiel Command, and industry are collaborating within the Power Transfer Cohort to advance concepts, designs, and proofs of technology that help to fast-track the Army's move to electric vehicles. This and other partnerships between the Army, academia, and industry aspire to develop enhanced power generation and distribution technologies to keep Army forces moving in austere environments. As solutions become available, the Army will develop the charging capability to meet the needs of fully electric tactical vehicles by 2050.

Anticipatory logistics, rather than being solely reliant on requests from the field, is another way to reduce sustainment demand. Analyzing data at scale and translating insights into actionable information without the need for manual request procedures is the key to unlocking anticipatory logistics. For example, the Army relies on thousands of spare parts delivered through long supply chains to maintain tactical momentum and operational reach. Once the Army can predict repair and maintenance demand in advance, Army logisticians will be able to optimize parts inventories and gain supply chain efficiencies, thereby reducing associated GHG emissions. Army Prognostic and Predictive Maintenance (PPMx) is demonstrating predictive logistics in action. PPMx is a set of linked components that provide self-diagnosis and automated maintenance alerts—capabilities the Army aims to include on all new vehicles and weapons systems. That, in turn, enables predictive and proactive maintenance management with lower demand for spare parts and reduces mechanics' workload per system. The Army will continue to develop predictive logistics initiatives like PPMx to drive more precise and faster decisions.

Many other initiatives show promise for further reductions in sustainment demand. Increasing repair part, component, and weapons system commonality and interoperability reduces requirements placed on supply chains, distribution networks, and contested lines of communication. Greater commonality and interoperability also increases the Army's ability to acquire parts globally. Water production at points of need and advanced manufacturing increase maneuver units' operational readiness and lessen their vulnerabilities. As a whole, advanced technology will increase unit endurance, sustain combat power, minimize environmental impacts, reduce the amount of fossil fuel the Army consumes, and help lower Army GHG emissions.



A U.S. Army Green Beret with 1st Special Forces Group (Airborne) sets up solar panels for operational communications at the National Training Center, Fort Irwin, California. The solar panels enable special operations forces to operate their equipment in the most remote locations and continue training forward of conventional forces while moving as a team through rough desert terrain, simulated ambushes, and limited communications. (Photo Credit: U.S. Army, Pfc. Lisa-Marie Miller)

Future Contingency Basing

Contingency bases are non-enduring locations that support specific military operations and missions. The life-cycle process for planning, designing, constructing, operating, managing, transitioning, and closing such locations is known as "contingency basing." Contingency basing delivers forward, protected presence—a vital element of nearly every mission. Policies and practices for contingency basing moving forward must account for all emerging threats, including threats from climate change. Next-generation contingency basing must mitigate GHG emissions while enhancing Army force projection and persistence in austere environments.

Electric service is a key component of contingency basing, but the heavy reliance on fossil fuels for electricity is hampering the Army while increasing risk and cost. The Army is already working with its commercial partners to revolutionize deployable power generation and storage. In 2013, the Army began fielding the Advanced Medium Mobile Power Source (AMMPS) family of generators. At present, AMMPS delivers about 20% better fuel efficiency, 90% better system reliability, and 52% parts interoperability, and the AMMPS can integrate into tactical microgrids. To reach their full potential though, these generators need to be deployed as part of a microgrid system paired with battery storage. The necessary battery technology exists and is improving every year, and the Army will move to acquire, implement, and help advance this technology. In addition, the Army will enact a new policy, setting standards for using the most energy-efficient systems available for contingency basing, including renewable generation and battery storage where possible, to minimize base fuel demands.

To ensure protection and sustainment during Multi-Domain Operations (MDO), future contingency basing must employ the latest capabilities informed by the best available planning tools. As systems become more complicated, the Army increasingly relies on automated and computer-enabled planning. The Army's Joint Construction Management System (JCMS) provides some of the best tools for contingency base life-cycle

management. The JCMS software suite enables site selection and master planning and provides a library of standard designs for initial, temporary, and semi-permanent construction. Another example, the Auto Distribution Illumination System, Electrical (Auto-DISE) is a planning and implementation tool that generates optimized layouts for command posts, field hospitals, and other forward-operating requirements. Planning informed by JCMS, Auto-DISE, and other advanced tools provides the insight needed to ensure that Logistics Civil Augmentation Program (LOGCAP) and operational contracts incorporate appropriate climate standards, and gives the Army flexibility to construct and maintain energy-efficient contingency basing. Once plans are set, the Army has a number of advanced technologies to deliver modern contingency basing. Force Provider Expeditionary (FPE) base camps, for example, offer a robust, self-contained, and transportable capability. From 2012 to 2017, FPE camps achieved over 30% reduction in their fuel and water usage. Since then, FPE camps have gained even more of the latest technology, including AMMPS generators with microgrids; efficient, lined shelters; water reuse capability; LED lighting; and better environmental control units. Through careful planning and execution, the Army will significantly reduce operational energy and water use by 2035, decrease risk to force, and achieve carbon-pollution-free contingency basing by 2050.

Clean Procurement

Army supply chains circle the globe and integrate thousands of vendors and other providers. Such a broad and diverse network can reduce emissions, promote environmental stewardship, support resiliency, drive innovation, and incentivize markets for sustainable products and services. The Army already complies with federal green procurement requirements supporting sustainable products made of recycled or recovered materials, which reduces waste and GHG emissions. In addition, the Army includes energy as a key performance parameter (KPP) in acquisition decisions and considers energy efficiency in contracting decisions. This allows the Army to deliberately evaluate competing options based on their efficiency and sustainability, among other factors. However, organizations across the Army have very different understandings of this KPP. To establish a common foundation for modernization, future acquisition, and contracts, the Army will revise the energy KPP for clarity and to better account for environmental impacts in decision-making. Once a shared understanding of the KPP has been reached, the Army will use the updated KPP to drive all future acquisition and contracting decisions.

Products made through clean and sustainable practices often cost less and require less maintenance than legacy equivalents. It is time to ask Army suppliers to further reduce both embodied emissions and the impact that supply chain activities have on the climate. To that end, the Army will adopt a Buy Clean policy for procurement of construction materials with lower embodied carbon emissions from manufacturing, transportation, installation, maintenance, and disposal sub-processes. The Buy Clean policy and potential future policies will facilitate an ambitious goal of net-zero GHG emissions from all Army procurements by 2050.

Resilient Supply Chains

Army supply chains are networks of military, governmental, and private organizations that create and deliver products and services to the Army, the Joint Force, and selected allies and partners. Resilient Army supply chains satisfy customer requirements while reacting quickly and efficiently to disruptions occurring within their networks. There are many potential sources of supply chain disruption, including tornados, hurricanes, and extreme weather events; land degradation; raw material shortages; and adversary actions. Achieving resilient supply chains requires a better understanding of the sources of disruption, deciding how much adaptation is needed in response, and selecting what portions of which supply chains merit Army attention. Army Materiel Command's ongoing supply chain optimization analysis is one of several strategic-level initiatives seeking exactly these results. The service will build on such efforts and adapt Army supply chains through a multi-step process. By 2025, the Army will analyze all of its Tier 1 sources and supply chain contracts for climate change risks and vulnerabilities. Wargames and simulations that "stress test" a supply chain will be particularly useful. By 2028, plans, policies, and contracts must be in place to ensure Army supply chain resilience. Finally, Army supply chain management must aggressively implement and proactively support the necessary initiatives to deliver Army supply chains capable of sustaining operations in competition, crisis, and conflict.

LINE OF EFFORT 3: TRAINING	
STRATEGIC OUTCOME:	
Prepare a force that is ready to operate in a climate-altered world	
INTERMEDIATE OBJECTIVES:	
3.1	Beginning in 2024, publish climate change lessons and best practices every two years
3.2	Update Army programs of instruction for leader development and workforce training to incorporate climate change topics no later than 2028
3.3	By 2035, increase the number of Soldiers and Army civilians serving in strategic headquarters with advanced credentials on climate change topics
3.4	Ensure that all Army operational and strategic exercises and simulations consider climate change risks and threats by 2028
3.5	Consider reduction of GHG emissions as a factor in planning to optimize the Army's mix of distributed learning, virtual learning, and resident courses
3.6	Develop ways to reduce direct GHG emissions resulting from Army individual and collective training by 2028

LINE OF EFFORT 3: TRAINING

Although the Army already trains its people to become world-class teams in a wide variety of environments and scenarios, the immediate and pressing nature of climate change means that today's training must account for this new, harsher reality. The Army as a whole must understand how future combat and non-combat operations will differ as a result of climate change.

To achieve this shared understanding, the Army must proactively train its people and **prepare a force that is ready to operate in a climate-altered world** while simultaneously maintaining the ability to win in combat. Such preparation requires shifts in *what* and *how* the Army trains its people, units, and headquarters. This effort not only seeks to adapt training to consider climate change implications, but also to update certain Army training practices to mitigate a portion of Army GHG emissions from training.

What the Army Trains

Army training must continually evolve to prime the force for new environments and threats. The next such evolution will account for climate change threats. The Army has already started building climate literacy into current training. This effort aims to provide an understanding of the Army's influence on the climate and climate change's influence on the planet. Army Materiel Command's "Climate 101" Course gives installation planners and garrison commanders an introduction to climate science and its implications for lands, energy, water, soil, and other installation issues. Over 450 professionals from across the Total Army have completed the course so far. The U.S. Army Corps of Engineers offers other courses on sustainability, resilience, energy, and master planning and will incorporate climate literacy into them. This is only the beginning. For some audiences, there will be purpose-built courses. For others, the next evolution means making smart decisions to integrate climate topics

Nearby wildfires cause a heat wave and heavy smoke that blocks out the sun at Fort Hunter Liggett, California, while Soldiers from the California Army National Guard's 79th Infantry Brigade Combat Team conduct a Warfighter exercise at the fort. (Photo Credit: Maj. Jason Sweeney)

into existing instruction and associated educational exercises. Overall, program of instruction (POI) updates will balance existing critical learning requirements and available time with the urgency of climate change. No matter how a particular course changes, revised training will always incorporate the latest climate science into training modules. To do so, the Army will publish climate change lessons learned and best practices every two years starting in 2024. The Army will fully implement climate-informed POIs no later than 2028, ensuring all Army people—and especially those on track for strategic leadership—are well educated in these critical issues.

There are also many existing programs through which dedicated Army professionals can develop climate-related expertise, including Advanced Civil Schooling and professional certifications. The Army needs only to encourage Soldiers and civilians to seize these opportunities and then apply their new knowledge when they return to the force. By 2035, the Army will have increased the number of professionals with civilian credentials in climate change topics serving in Army Command, Direct Reporting Unit, and Army Service Component Command headquarters. The Army will also request the resources needed to increase installation-level climate expertise to assist senior and garrison commanders.

How the Army Trains

At every echelon, the Army prepares for war through tough and realistic training. Imperatives to train today are just as strong as they have ever been. Going forward, the ways in which the Army trains will account for observed changes in both potential adversaries and in the Arctic, desert, mountain, and jungle environments where the Army could be employed. One example of such adaptation is an ongoing series of Army cold weather exercises with Canada, Norway, and Iceland, which featured six events in 2020 alone. Other similar initiatives are needed to make Soldiers, equipment, and units ready

for hot, cold, wet, and dry extremes beyond what they have previously experienced. By working purposefully, all Army operational and strategic exercises and simulations will consider climate change risks and threats by 2028.

In the past, face-to-face instruction was the Army's preferred method of professional education. This sometimes involved relocating personnel, families, and household goods multiple times between assignments. This practice can adjust in light of better information technology, the proliferation of broadband internet service, and new collaborative platforms that enable desired training outcomes through remote instruction. Today, the Army must factor in climate impacts when comparing the costs and benefits of different ways of training the force, balancing training in person when necessary, while minimizing disruption and GHG emissions when practical. By evaluating the options at its disposal, the Army will optimize the mix of distributed learning, virtual learning, and resident courses in its strategic training plans by 2028.

To develop the expertise, trust, and capabilities of its units, the Army relies on a series of successively larger collective training exercises. Posturing for these training events often involves moving large numbers of personnel, rolling stock, and shipping containers. The training events themselves also demand significant run time from fossil-fuel-burning vehicles and generators in austere environments. All of this results in substantial Army GHG emissions. While training may look different in the future, the Army will ***not*** simply cancel training or other readiness-generating activities to mitigate climate change. Rather, Army collective training will adapt through better policy, improved technology, and innovative approaches. In conjunction with greater efficiencies through modernized equipment, the Army will assess and update how units prepare for, rehearse for, deploy to, and execute collective training exercises. The Army must train, and units should train as they will fight. The key is to train smarter and develop ways to reduce direct GHG emissions resulting from Army individual and collective training by 2028, while maintaining the Army's ability to win decisively in combat.

Conclusion

The Army will remain ready for its primary mission first and foremost: to deploy, fight, and win the nation's wars by providing ready, prompt, and sustained land dominance as part of the Joint Force. To do this most effectively, the Army must address the impacts of climate change. The service is undertaking many efforts already, but action must be diversified and expanded to fit the magnitude of today's climate change threats.

Now is the time to create irreversible momentum that enhances readiness and resilience for the next 30 years. By building upon decades of research, development, and innovation, the Army will become the resilient and sustainable land force the Nation needs. The imperative is clear: The Army must help the United States mitigate climate change while ensuring competitive overmatch in crisis and conflict, and adapting to a rapidly changing landscape.

Climate change poses unique challenges to the Army at all levels. Bold actions now will ensure the Army is ready to support our nation in competition, crisis, and conflict far into the future.

By implementing this strategy, **the Army will be a resilient and sustainable land force able to operate in all domains with effective mitigation and adaptation measures against the key effects of climate change, consistent with Army modernization efforts.**

GLOSSARY

Adaptation. Adjustment in natural or human systems in anticipation of or response to a changing environment in a way that effectively uses beneficial opportunities or reduces negative efforts. (DoD Directive [DoDD] 4715. 21)

Army Senior Commanders. Designated by Army senior leadership to exercise command of Army installations. The command authority over the installation derives from the Secretary of the Army's Title 10 authority over installations and is a direct delegation of command authority for the installation to the Senior Commander. The delegated authority includes all authorities inherent in command. The Senior Commander is normally, but not always, the senior General Officer at the installation. The Senior Commander uses the garrison command as the primary organization to provide services and resources to customers in support of accomplishing the installation command mission. (Army Regulation [AR] 600-20)

Carbon-pollution-free electricity. Electrical energy produced from resources that generate no carbon emissions, including marine energy, solar, wind, hydrokinetic (including tidal, wave, current and thermal), geothermal, hydroelectric, nuclear, renewably sourced hydrogen, and electrical energy generation from fossil resources to the extent there is active capture and storage of carbon dioxide emissions that meets U.S. Environmental Protection Agency (EPA) requirements. (Executive Order [EO] 14057, Section 603d)

Climate change. Variations in average weather conditions that persist over multiple decades or longer that encompass increases and decreases in temperature, shifts in precipitation, and changing risks of certain types of severe weather events. (DoDD 4715. 21)

Extreme weather events. Occurrences of unusually severe weather or climate conditions that can cause devastating impacts on communities and agricultural and natural ecosystems. (U.S. Department of Agriculture)

Greenhouse gases (GHG). Gases that trap heat in the Earth's atmosphere. They include carbon dioxide, methane, nitrous oxide, and chlorinated and fluorinated gases, and can be natural or anthropogenic. (EPA)

Hybrid vehicle. A road vehicle powered by an internal combustion engine in combination with one or more electric motors that uses energy stored in on-board batteries. The Army considers hybrids a potential bridging solution between legacy vehicle fleets powered entirely by internal combustion engines and future fleets powered entirely by zero-emission powertrains.

Installation. The real property of a base, camp, post, station, yard, center, or other activity under the jurisdiction of the Secretary of the Army, including any leased facility, or in the case of an activity in a foreign country, under the operational control of the Secretary of the Army, without regard to the duration of operational control. Army installations may consist of one or more real property sites. The term includes federally owned or federally supported (state-owned but operated and maintained with federal funds) Army National Guard sites and facilities designated as depots, arsenals, ammunition plants, hospitals, terminals, and other special mission activities. It does not include any state-owned/state-supported (owned, operated, and maintained with state funds) National Guard installation or facility. Nor does it include any facility used primarily for Civil Works, rivers and harbors projects, or flood control projects.

Land degradation. Long-term changes in land and soil (especially as a consequence of human activity), which result in soil loss, reduced soil fertility, coastal erosion, land subsidence, a reduced ability of the land to support native plants and animals, and reduced agricultural yields. Desertification is one type of land degradation. (DoD Installation Exposure to Climate Change at Home and Abroad, April 2021)

GLOSSARY CONTINUED

Microgrids. Local electrical systems with the controls to manage multiple generation sources and loads. They can also disconnect from the power grid to operate independently during outages of the regular grid. A microgrid may reduce energy costs by providing grid services to the regular utility provider, such as demand response and frequency regulation. (Army Installation Energy and Water Strategic Plan, October 2020)

Mitigation. As it relates to climate change: Measures to reduce the amount and speed of future climate change by reducing emissions of heat-trapping gases or removing carbon dioxide from the atmosphere. (DoD Climate Risk Analysis, October 2021)

Net-zero emissions. A condition achieved when anthropogenic emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals of those same gases over a specified period (Special Report: Global Warming of 1.5 ºC, 2018). In this strategy, the "specified period" is a rolling 12 months generalized as, but not necessarily synchronized with, a given calendar year.

Non-tactical vehicle. A motor vehicle or trailer of commercial design acquired and assigned on the basis of authorization documents and used for providing administrative, direct mission, or operational transportation support of military functions. These roles include common support of installations and personnel; dedicated support to a specific unit or training activity; and conducting combat, tactical, and training operations. (AR 58-1)

Operational Energy. The energy required for training, moving, and sustaining military forces and weapons platforms for military operations. It includes energy used by power systems, generators, logistics assets, and weapons platforms employed by military forces during training and in the field. It does not include either the energy consumed by facilities on permanent DoD installations (except installations supporting military operations), or the fuel consumed by non-tactical vehicles. (DoDD 5134.15)

Resilience. The ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions. (DoDD 4715. 21)

Sustainability. The property of being environmentally **sustainable**; the degree to which a process or enterprise is able to be maintained or continued while avoiding the long-term depletion of natural resources. (Oxford English Dictionary)

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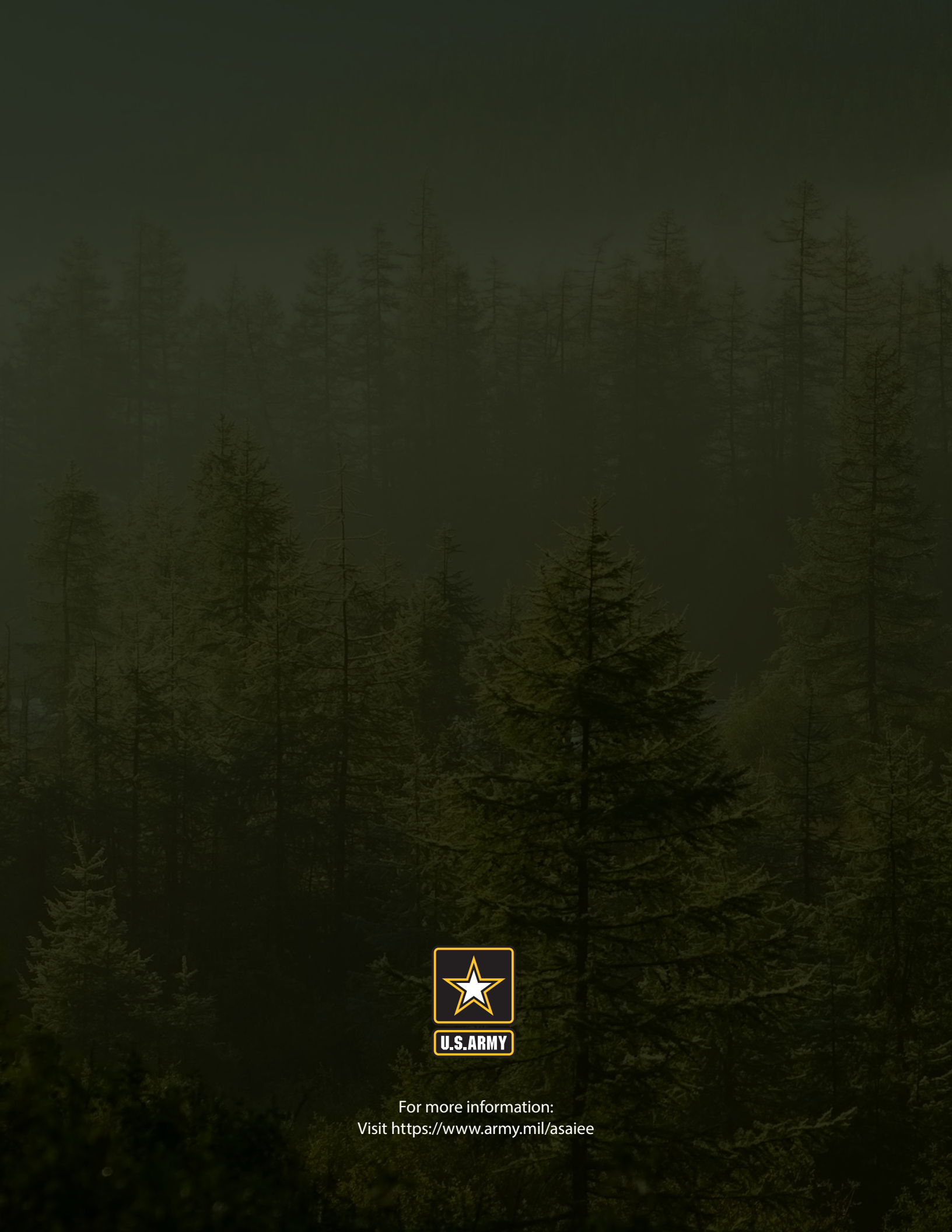

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