

# Net Zero: How Communities Can Support the Army's Sustainability Initiative

## Introduction

The Army launched the Net Zero Initiative in October 2010, and by April 2011 the service had selected 17 pilot installations striving to reduce consumption of resources in one or more of three categories — energy, water and waste — to an effective rate of zero by 2020. The office of the assistant secretary of the Army for installations, energy and environment (OASA IE&E) introduced the Net Zero Initiative to move Army installations beyond simply complying with environmental regulations and federal mandates in pursuit of setting a higher standard. The initiative is supporting pilot installations and aims to share lessons learned and best practices with all installations.

Many of these lessons are presented in this article for the same purpose — to engage the communities that support military installations to improve the prospects for successfully implementing Net Zero. The article will examine Net Zero energy, Net Zero water and Net Zero waste activities completed by the pilot installations, with the goal of assessing the potential implications for defense communities. After covering the background of the initiative, the paper reviews some major challenges in implementing Net Zero and other observations about the path forward.

If DoD installations are to embrace the Net Zero Initiative, it is important that the effort not add to the many operations and maintenance challenges already facing them. Ideally, the initiative will spark a new emphasis on goals that communicate readily across the often-disconnected domains of installation management. As a result, Net Zero will require innovative approaches requiring Army

personnel and other stakeholders to move beyond the prevalent compliance-based culture. In turn, defense communities will need to increase their support for local installations.

The communities that need to be engaged include businesses and contractors, which provide goods and services; utility providers, including municipalities and private operators; residents, especially those that live and work on installations; and state and federal agencies with oversight over the region where installations are located. Successfully attaining Net Zero cannot occur solely through the efforts of directorates of public works (DPWs); it truly will require a community effort. Each of these community members must be engaged to successfully trim water and energy consumption, divert waste materials and generate renewable energy.

The Army is not the only service carrying out a Net Zero policy for installations. The office of the chief of staff for the Air Force issued a Net Zero energy, water and waste policy<sup>1</sup> in 2012 to fulfill regulatory and executive order (EO) mandates, and to support the *Air Force's Energy Plan*<sup>2</sup> and the *Air Force Implementation Plan for the Department of Defense Strategic Sustainability Performance Plan*.<sup>3</sup> The policy also calls for installations to achieve more ambitious goals than those set by regulation. Similarly, the Navy secretary set a Net Zero energy goal for installations in the *Navy's Energy Program for Security and Independence*.<sup>4</sup> The goal calls for 50 percent of Navy installations to be Net Zero by 2020, and urges installations to go beyond federal mandates and statutes as they strive to achieve energy security and energy independence.

## Army Secretariat Net Zero Initiative

The Army created the Net Zero Initiative shortly after Katherine Hammack was appointed assistant secretary of the Army for installations, energy and environment by President Obama in June 2010. During visits to posts early in her tenure, installation officials lauded their accomplishments for meeting, or progressing toward, mandated energy and environmental goals, including those called for in the 2005 Energy Policy Act (EPAAct), the 2007 Energy Independence and Security Act (EISA), EO 13423 of 2007, and EO 13514 of 2009. Hammack's initial response was to ask whether the installation could have made greater gains with the same investment. She wanted to encourage Army installations to strive toward the most sustainable and energy-efficient solutions possible under existing budget constraints.

The result was the Net Zero concept, which calls for installations to:

- produce as much energy onsite as they consume annually;
- limit the consumption of freshwater resources and return water back to the same watershed so as not to deplete the region's groundwater and surface water resources; and
- reduce, reuse and recover solid waste streams by converting them to resource values with zero solid waste to landfill.



Figure 1. The Army's Net Zero Concept<sup>5</sup>

The Net Zero concept, depicted in Figure 1, is based on a hierarchy of activities that seek reduction first and foremost — reduction through better design, improved management, reduced requirements, or behavioral and cultural change. It stresses that installations first seek low-cost and easy-to-implement activities — such as improving energy efficiency in existing facilities, implementing water efficiency practices and eliminating generation of unnecessary waste. The concept then moves on to other activities needed to efficiently meet energy and water demand or eliminate solid waste to landfill. Recovering energy through cogeneration

or recycling water through reclaimed water systems should take precedence over the pursuit of new sources. Likewise, recycling, composting and re-purposing should take precedence over waste-to-energy conversion. Developing new energy projects and disposing of waste in landfills should be the last options. All of these approaches must be woven into existing planning efforts and linked to ongoing programs.

The Army held a competition for installations to become Net Zero pilot sites. After a rigorous evaluation process that relied on the support

of technical advisors from the National Renewable Energy Laboratory, the Pacific Northwest National Laboratory, and the National Defense Center for Energy and Environment, officials selected six installations for each of the three Net Zero resource categories, as shown in Table 1. Two Net Zero installations and the Oregon Army National Guard are pursuing all three areas simultaneously. The OASA IE&E received over 100 self-nomination packages — 53 energy, 23 water and 24 waste — from 60 posts and Army National Guard facilities. These installations were selected to represent a variety of Army commands, geographic locations and types of installations to allow the service to develop best practices as the Army shifts all of its installations closer to Net Zero.

The target date for installations to reach their Net Zero goals is fiscal 2020.

**Table 1. Army Net Zero Pilot Installations**

Energy	Water	Waste	Integrated
Fort Detrick, Md.	Aberdeen Proving Ground, Md	Fort Detrick, Md.	Fort Bliss, Texas
Fort Hunter Liggett, Calif.	Camp Rilea, Ore.	Fort Hood, Texas	Fort Carson, Colo.
Kwajalein Atoll, RMI	Fort Buchanan, P.R.	Fort Hunter Liggett, Calif.	
Parks Reserve Forces Training Area, Calif.	Fort Riley, Kan.	Fort Polk, La.	<b>State-Wide</b>
Sierra Army Depot, Calif.	JB Lewis-McChord, Wash.	Joint Base Lewis-McChord, Wash.	Oregon Army National Guard
U.S. Military Academy, N.Y.	Tobyhanna Army Depot, Pa.	United States Army Garrison Grafenwoehr, Germany	

During Net Zero’s first two years, leaders at the pilot installations closely engaged with planning activities and dedicated staff resources toward the initiative. In addition, OASA IE&E assisted the pilots by providing technical resources to establish baselines, assess potential Net Zero actions, and identify additional solid waste reuse and diversion opportunities. The pilot installations participated in conference calls, training sessions and workshops to enhance collaboration and share expertise. The installations are working to integrate the results into existing programs and continue to collaborate with OASA IE&E and other installations to reach Net Zero objectives by 2020.

Through the pilot sites’ efforts, the Army has learned much about achieving Net Zero. While many opportunities still remain for installations to develop more efficient operations and improve long-standing sustainability practices, there are many roadblocks to realizing the aims of the initiative. The most challenging factor is that working towards Net Zero requires a diverse and motivated team, focused on changing the behavior of all installation personnel. Implementation teams should include personnel drawn from a garrison’s public works, master planning and environmental staffs, as well as support from commands, the assistant chief of staff for installation management, private and public utilities, and technical experts.

Equally significant in a climate of fiscal constraint is the need for installations to consider leveraging private-sector financing if new projects are needed to meet their goals. Section 331 of the FY 2013 National Defense Authorization Act provides the military services sole-source authority to partner with municipalities for installation services.<sup>6</sup> The ability to carry out intergovernmental support agreements between military installations and neighboring municipalities provides ample opportunities for community members to support DoD's Net Zero goals.

During FY 2014, the Army began taking the lessons learned and best practices from the initiative to develop a policy to expand Net Zero enterprise-wide. The original pilot installations will continue to work toward a Net Zero goal by 2020, while the remaining Army posts will be directed to strive toward Net Zero goals when fiscally prudent.

### **Net Zero Energy**

Achieving Net Zero energy requires an installation to cut overall energy use, maximize energy efficiency, and implement demand management and energy recovery practices. Once these avenues have been pursued, installations then offset the remaining energy demand through the production of onsite renewable sources so they produce as much energy onsite as they consume over the course of a year.<sup>7</sup>

The path to Net Zero energy requires careful planning that takes into account the need for conservation awareness throughout the installation community. It also requires technological solutions for facility efficiency gains as well as larger-scale, onsite generation with effective management and control of those assets. Robust partnerships are necessary to encourage public utilities to support large-scale renewable energy projects and negotiate with the private contractors that own and operate the electrical infrastructure at many installations.

Understanding the installation energy baseline and future growth from a master planning perspective is essential to laying out an integrated approach to Net Zero energy. As a result, Net Zero installations use cross-functional teams, including mission representatives, privatized utility providers and residential community managers, to provide input for planning as well as current construction. Hosting planning meetings akin to a charrette can ensure innovative ideas are considered as part of the design for improving energy efficiency. Mission growth can provide insight into potential increases in load when considering an expansion in energy needs.

Education and awareness are important ongoing activities at Net Zero energy installations. Engagement within the community involves existing staff, private utilities and building occupants. One approach to encouraging energy reduction through behavioral change is employing facility manager and building energy monitor (BEM) programs.<sup>8</sup> BEM programs leverage the institutional knowledge of building occupants to identify and eliminate energy waste. Buildings have unique efficiency opportunities based on mission requirements and building use.

Fort Carson reinvigorated its BEM program and developed facility manager standard operating procedures. The installation enhanced its existing facility manager and BEM programs through increased staffing and training, and improved recognition of individual efforts. West Point found that when BEMs speak to building occupants about energy conservation, individual initiatives to improve energy efficiency rose 19 percent. Others, such as Fort Detrick, have rewritten energy policies and created garrison energy steering committees.

Net Zero installations also have used energy consumption reporting to increase awareness of energy use among building occupants. Participation in conferences has proved valuable, as installations promote what they are working on through local, state and professional networks. Fort Carson,

for instance, participates in the annual Colorado Sustainability Conference.

Energy use touches all aspects of the installation community, including housing. Privatized family housing partners are important stakeholders in Net Zero success. Installations have implemented various Net Zero best practices in residential neighborhoods, relying on the housing manager and residents to test new concepts and change energy use patterns.

One example is “mock billing” programs that charge a premium if energy, or water, use exceeds a monthly average. Conversely, credits and refunds can be applied if the housing unit consumes less than the monthly average. These programs have been demonstrated at Fort Bragg and Fort Bliss. Outreach and education programs in residential communities seek to include service members’ families in an installation’s Net Zero efforts. Testing as many best practices as possible in a family housing demonstration may enhance the adoption of best practices for the entire neighborhood.

Net Zero energy pilot sites have relied heavily upon facility upgrades and new technologies to meet their goals. For efficiency projects and onsite generation development, partnerships with industry and utility providers are a critical component of success. The Net Zero sites have leveraged multiple federal authorities that take advantage of public-private partnerships and third-party financing options to invest in upgrading energy infrastructure and increasing onsite generation. Some examples include energy savings performance contracts (ESPCs), utility energy savings contracts and enhanced use leases (EULs) in conjunction with power purchase agreements (PPAs).

Net Zero objectives provide additional justification for industry to work collaboratively with an installation to implement such projects. Installations have used these partnerships to fund street light replacements, lighting retrofits, occupancy sensors, energy management control systems, substation and line upgrades, microgrids, building envelope upgrades,

boiler upgrades and window replacements. A steam decentralization project at Fort Detrick is expected to reduce natural gas consumption in affected buildings by 50 percent.

Net Zero installations also have leveraged DoD’s energy conservation investment program (ECIP) and sustainment, restoration and modernization (SRM) funds for similar upgrades and efficiency measures, as well as the installation of solar arrays, solar hot water systems and ground-source heat pump systems. The Oregon Army National Guard, for example, leveraged an ESPC to install lighting upgrades at an industrial site for an estimated 39 percent reduction in energy use. HVAC improvements, lighting upgrades, window upgrades and building envelope improvements resulted in an estimated 31 percent energy savings at another Oregon Army National Guard site.

An example of successful collaboration with a community partner is the installation of solar power on family housing developed through the Army’s Residential Communities Initiative (RCI). Solar power vendors have worked closely with RCI partners and Net Zero energy installations at Fort Bliss and Fort Carson to place solar arrays on homes that are operated and managed through the RCI. These efforts require collaboration with the utility provider to ensure the current infrastructure can accept the power generated. In some cases this means working with a private utility if the installation’s system has been privatized.

As with all renewable power generation, utility providers are key stakeholders to address interconnection and backflow concerns. The installations need to ensure solar energy doesn’t cause unintended consequences in power quality or interfere with a privatized utility’s distribution system. Other installations have successfully employed PPAs to execute long-term contracts for renewable energy that are below local retail rates for electricity. Fort Detrick is working with a solar power vendor to

install solar panels on 80 acres of the post under a PPA. Solar and wind power may be generated from a project onsite — through an EUL, for example — or through renewable energy credits for power generated offsite.

In another case of community collaboration, the Oregon National Guard has worked with Drive Oregon, the state electric vehicle organization, to install electric vehicle charging stations along the Interstate 5 corridor in advance of the Guard's purchase of electric vehicles through DoD's plug-in electric vehicle program. In another partnership, the Oregon National Guard leveraged a U.S. Forest Service grant to investigate biomass district heating potential for the Umatilla Training Center.<sup>9</sup> Fort Carson has worked with its electricity provider, Colorado Springs Utilities, to provide waste wood material from the installation for the utility's wood- and coal-fired power plant. The installation receives up to 5 percent of its power needs in return. These community-military partnerships all contribute to Net Zero's success.

The primary intent of Net Zero energy is to ensure the military mission can be sustained over the long term. But another driver is ensuring energy is available in times of crises or natural disasters, as installations must ensure continuity of operations and provide support to surrounding communities in these circumstances. Internal and external stakeholders engaged in emergency response and contingency planning, therefore, are additional members of the military community that are needed to support Net Zero initiatives.

### **Net Zero Water**

Achieving Net Zero water requires an installation to trim overall water use, regardless of the source; increase reliance on technologies which use water more efficiently; shift potable water use to non-potable sources as much as possible; and minimize inter-basin transfers of any type of water, potable

or non-potable, so that the installation recharges as much water back into the local aquifer as it withdraws.<sup>10</sup>

Successfully implementing these strategies requires behavioral change and conservation awareness throughout the installation community. Creative funding mechanisms are often needed as the low cost of water makes for long payback periods. It also requires effective and ongoing partnerships with utilities — both municipal and privatized utility providers on the installation.

As installations strive to reach Net Zero water goals, outreach efforts are important. Net Zero pilots have created new water conservation policies, councils for water stakeholders to share information and identify priorities, and award programs to recognize exemplary efforts by individuals. Awareness can be focused externally, such as participating in state-level water conferences to learn about regional water concerns, or internally, such as Aberdeen Proving Ground publishing articles in the post newspaper about its participation as a Net Zero water pilot.

Other installations have integrated Net Zero water seamlessly into their existing sustainability efforts, such as Joint Base Lewis-McChord officials featuring the initiative in the installation's regular community sustainability breakfasts. Other educational efforts have focused on working with maintenance departments to ensure that new fixtures operate properly and correct spare parts are kept on hand. Without this outreach, personnel may revert to old habits which squandered water.

ESPCs feature heavily in the financing of water conservation and efficiency projects. Installations have leveraged these funding mechanisms to overcome chronic shortages in operation budgets. The ESPC contractor becomes the installation's partner in plumbing retrofits at pilots such as Fort Bliss and Fort Carson. These upgrades — low-flow toilets, low-flow shower heads and faucet aerators — are low-cost improvements that, when bundled

together, can produce significant water and energy cost savings over time, drawing the interest of ESPC contractors. For installations in areas with high potable water costs, the projects are even more desirable; one Net Zero pilot, Fort Buchanan, leveraged an ESPC to install a water well and storage pond to avoid using municipal water for golf course irrigation.

Alternative water sources have proven essential for the Net Zero pilots to reach their goals. The reuse of water within wastewater treatment plant operations is saving Tobyhanna Army Depot 5,000 to 6,000 gallons per month in potable water. Several installations, including Camp Rilea, are using water reclaimed after wastewater treatment for irrigation. For some, this means expanding existing systems with more pumps, pipes and storage ponds to increase their capacity to use reclaimed water.

Fort Carson has leveraged ECIP funds combined with SRM funds to enhance its reclaimed water system. Fort Bliss is starting from scratch with new purple pipe distribution systems to accept reclaimed water from the local municipality and is relying on an ESPC to provide the resources for the new infrastructure. At Aberdeen Proving Ground, water treated onsite for an underground contamination plume will be diverted as process water in the boiler plant, also through an ESPC.

Public water utilities and private utility providers are a critical component of potable water provision for military installations. These utilities have the expertise and knowledge needed to effectively operate the systems, and are in a position to identify opportunities to cut water use. Utilities also play a critical role in implementing solutions. Collaboration and partnering with a public utility provider will enhance the installation's success.

Municipalities in water-scarce regions, for example, conduct water conservation programs and are aggressive about leak detection. The experience of those utilities can be transferred to installations

to advance their Net Zero water efforts. As noted above, the local municipality may have reclaimed water that the installations could procure to help reduce potable water demand. An installation's Net Zero objectives may provide a utility the needed incentive to prompt greater investments in water reclamation infrastructure outside the fence.

Similarly, installations with privatized utilities will rely on those partners to achieve success. Replacing water fixtures to increase efficiency is a large part of Net Zero, but other strategies need to be explored as well. Leak detection and repair also play a role and, for utilities that are privatized, this must be done through existing contracts. Management approaches to ensure adequate pressure and flow also can play a role, again with the help of the private utility partner.

Coordination is essential to ensure changes made by the installation, its tenants and the utility all work in concert and do not result in unintended outcomes. For instance, fire suppression, backup power generation and other mission-critical functions that depend upon water must be factored into utility planning, capital improvements and Net Zero efforts. Integrated Net Zero — pursuing the initiative in energy, water and waste — requires a privatized utility to look for other efficiency improvements and not focus solely on trimming overall water use. Water treatment and pumping are energy intensive; the utility needs to take this relationship into account and implement other measures that reduce energy use or solid waste generation resulting from its operations.

The Net Zero water installation may also need support from regulators if it seeks to use alternative water sources, such as greywater or stormwater. The capture and use of stormwater may help in regions where stormwater management is a critical issue.

## Net Zero Waste

Achieving Net Zero waste requires an installation to reduce, reuse, recycle, compost and recover solid waste streams, converting them to resource values that result in zero landfill disposal.<sup>11</sup> Successful Net Zero waste initiatives by the Army will involve local municipalities, businesses, nonprofits and the community at large.

Net Zero waste programs will require greater interaction with local municipalities as economies of scale are critical to successful recycling, reuse and composting. Installations often do not have sufficient quantities of materials to justify these programs, but when combined with the local community's waste stream, new markets and other opportunities emerge. Local cities and counties often have programs in place for recycling that an installation could participate in.

For instance, one defense community recycles porcelain sinks and toilets by crushing the material and using it as road base. An installation was able to divert its waste porcelain through that county's existing program. Installations can work with local municipalities to raise awareness of recycling. America Recycles Day events are one example of a way to collect a significant amount of electronic waste, data media, old medicine and household hazardous waste that installation recycling programs cannot manage. These types of events can spur interest in additional collection efforts or new recycling points. An installation's contributions to new diversion or recycling efforts potentially can provide the tipping point to turn these waste streams into viable markets for the municipality or local entrepreneurs.

A change in incentives for contracted waste haulers would help them become significant partners in Net Zero waste efforts. Current contract vehicles generally provide an incentive for haulers to handle more tonnage, rather than less. New performance-based solid waste collection contracts that provide

incentives to reduce the amount of solid waste hauled to landfills, however, would promote an installation's Net Zero goals. The adoption of new contract mechanisms by private waste companies would help both be successful.

Similarly, service contractors that provide custodial services to installations play a key role in monitoring and implementing recycling, and can help divert more recyclables from the waste stream to recycling containers. Shifting expectations of the services they provide and adopting creative contract incentives could help those contractors remain viable while supporting an installation's Net Zero goals.

Installations' success in achieving Net Zero waste will rely on multiple community partners to address specific waste streams, such as food waste. Nonprofit agencies may accept food donations, reducing a source of organic waste. The municipality may have a composting program that could accept discarded organic materials. Private trash haulers would need to transport this segregated waste stream. One of the Net Zero waste installations has been working with its solid waste collection hauler and a local food bank. Installations and their community partners will need to reach new arrangements that are mutually beneficial.

Federal partners are also a critical part of the Net Zero waste initiative. The Army and Air Force Exchange Service (AAFES) can be an active partner in waste reduction by changing shipping and packaging disposal techniques and donating to food banks. Something as simple as eliminating plastic shopping bags starts with AAFES support and involvement within the community. Federal Prison Industries Inc. is another potential partner. Fort Carson works with UNICOR, a subsidiary of the federal prison system, to use prison inmates as labor for disassembling electronics. The partnership is allowing the post to divert electronic waste without additional cost.

Military families will play a role as well in helping installations achieve Net Zero waste — activities such as installation-wide garage sales or weekly drive-thrus for residents to drop off recyclables likely will prove essential. One installation, for example, established a “citizens brigade” to support its recycling and waste reduction efforts. Beyond a post’s residential communities, efforts will need to include those that live off the installation.

### **Path Forward**

The Net Zero Initiative will be successful only with the support and enthusiasm of the entire community of stakeholders associated with an installation. Implementing Net Zero practices cannot be viewed as a responsibility for installations’ DPWs. There are many challenges the host community and private sector can help the services address, including technical execution, alternative financing, and winning over the hearts and minds of stakeholders.

Installations will rely on technical support from a variety of partners, starting with privatized utilities and public utilities. Other entities that will need to be partners in achieving Net Zero include service contractors performing installation management, the privatized managers of family housing and other companies performing operations and maintenance on an installation. Commercial tenants, such as stores and restaurants, along with other DOD and federal tenants also have a role to play.

To move forward on the initiative, this mixture of stakeholders must be aligned with the Army’s Net Zero vision so that its requests for changes in performance expectations, construction requirements, conservation programs, metrics reporting and other efforts are quickly adopted.

Another of the major challenges in implementing Net Zero is cost. Installations’ DPWs do not have a dedicated funding stream to pay for Net Zero

initiatives and, in fact, believe the initiative will save money. As a result, installations will need to leverage the resources of their community partners to carry out initiatives, while limiting additional expenditures by the Army.

Public-private ventures such as ESPCs and PPAs will require patience and persistence to execute as these are often complex arrangements. The service provider and DoD will need to collaborate to offer contract incentives to reduce energy and water consumption, increase recycling or improve material take-back programs. Performance-based contracting has proven to be successful, as long as all the appropriate performance objectives are employed. If performance expectations are shifting, the contracting commands need to be able to write contracts to include new objectives. Service providers first will need to recognize how existing contracts can encourage or deter actions supporting the Net Zero Initiative, and then accept new contract mechanisms.

Finally, shifting from a compliance-based to goal-oriented culture when it comes to realizing DoD’s environmental objectives will require winning over the hearts and minds of more than the service members at an installation, but also the numerous community partners which support day-to-day installation functions. All individuals living and working on an installation have a role to play as they occupy buildings, consuming energy and water and generating waste. They can make a difference whether they are personally responsible for replacing failing heating and ventilation systems, purchasing copiers, maintaining ranges, stocking store shelves, cooking meals, washing clothes or watering lawns. Outreach programs are essential building blocks toward more efficient operations. Community members must embrace new sustainability practices and apply them to achieve the Net Zero goals of their installations.

## End Notes

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