Army Net Zero Initiative

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(Energy & Sustainability)
Agenda

- Overview of Net Zero
- Energy
- Water
- Waste
- Collaboration, Integration and Next Steps
Army Resilience

- Resilience: perform all missions under a variety of adverse conditions
- Applies to people & organizations
- Army installations must be resilient in order to carry out their mission:
  - Indirect: Fukushima, Japan
  - Direct: Fort Leonard Wood, MO; Fort Bragg, NC
- Net Zero strategies improve resilience by improving energy & water security
Drivers of Change

Energy security, surety, and reliability

Risk reduction

Increasing energy prices / Fully burdened cost of fuel

Improved operational capabilities

Foreign energy sources

Federal and DoD mandates

Environmental concerns

Resulted in Creation of Army Net Zero for Energy, Water, and Waste

Assistant Secretary of the Army (Installations, Energy & Environment)
Net Zero INSTALLATION:
Applies an integrated approach to management of energy, water, & waste to capture & commercialize the resource value and/or enhance the ecological productivity of land, water, & air.
Pilot Installations

Net Zero Pilot Installations:
- Aberdeen Proving Ground
- Camp Rilea
- Fort Bliss
- Fort Buchanan
- Fort Carson
- Fort Detrick
- Fort Hood
- Fort Hunter Liggett
- Fort Polk
- Fort Riley
- Grafenwoehr
- Joint Base Lewis-McChord
- Kwajalein Atoll
- Parks Reserve Forces Training Center
- Sierra Army Depot
- Tobyhanna Army Depot
- West Point

State-Wide Pilot:
- Oregon Army National Guard
Army Net Zero Energy
Net Zero ENERGY: Reduce overall energy use, maximize efficiency, implement energy recovery & cogeneration opportunities, & then offset the remaining demand with the production of renewable energy from on-site sources, such that the Net Zero energy installation produces as much renewable energy as it uses over the course of a year.

Holistic Approach Includes:

- Thermal & electric energy
- Dramatic demand-side energy use reduction
- Right mix of energy generation technologies & strategies that also increase energy security
- Areas/building clusters served by smaller Central Utility Plants & microgrids
- Flexible implementation strategies based on potential technology innovations & mission changes
- Enhances energy awareness & promotes behavior/cultural change
Audits & Roadmaps

- **Establishing the baseline**
  - Completed energy audits at Net Zero energy pilot installations
  - Installing advanced meters & a meter data management system
  - Conducted energy security assessments at select sites

- **Assessing the potential**
  - Conducted renewable energy audits at Net Zero energy pilot installations
  - Identified opportunities for small and large-scale renewables
  - Coordinating with the Energy Initiatives Task Force for projects >10MW

- **Planning the future**
  - Completed Net Zero 2020 roadmaps for energy with project lists & actions to implement over the next 7 years
  - Developing programming documents for energy conservation & other funding programs
Energy Roadmaps

- Energy Baseline
- Energy Efficiency Assessments
- Renewable Energy Assessments
- Energy Security Assessments
- Energy Project List & Implementation Recommendations

Sierra Army Depot Load Reduction & Renewable Energy Integration Roadmap

- 25% EE Assumption
- NZEI

- Solar Vent Pre-Heat
- Solar Hot Water
- Daylighting
- Ground Source Heat Pumps
- Solar Photovoltaic
- Geothermal Electric
- Future Solar / Geo (Elec)
- 2011 Baseline (Elec)
- 2011 Baseline (Heat)
## Net Zero Energy Summary

<table>
<thead>
<tr>
<th>Installation</th>
<th>EE Estimate*</th>
<th>% Thermal RE</th>
<th>% Electrical RE</th>
<th>% Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camp Parks</td>
<td>31%</td>
<td>86%</td>
<td>100%</td>
<td>96%</td>
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<tr>
<td>Ft. Bliss</td>
<td>15%</td>
<td>46%</td>
<td>100%</td>
<td>78%</td>
</tr>
<tr>
<td>Ft. Carson</td>
<td>17%</td>
<td>93%</td>
<td>100%</td>
<td>96%</td>
</tr>
<tr>
<td>Ft. Detrick</td>
<td>20%</td>
<td>45%</td>
<td>71%</td>
<td>76%</td>
</tr>
<tr>
<td>Ft. Hunter Liggett</td>
<td>38%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Kwajalein</td>
<td>25%</td>
<td>NA (all electric)</td>
<td>83%</td>
<td>83%</td>
</tr>
<tr>
<td>Oregon NG</td>
<td>47%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Sierra AD</td>
<td>25%</td>
<td>100%*</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>West Point</td>
<td>22%</td>
<td>58%</td>
<td>100%</td>
<td>77%</td>
</tr>
</tbody>
</table>

* Estimate of energy efficiency measures implemented at each installation.
**Net Zero Energy – Fort Carson**

- **Energy Efficiency Improvements**
  - Funded projects since 2011: boiler replacements, lighting retrofits, control improvements, HVAC upgrades
  - 3rd Party financed ESPC in 2013 included lighting, variable frequency drives, envelope improvements & water fixture replacements
  - Focused effort to reduce energy using the Energy Management Control System to improve scheduling of facilities’ thermostat settings

- **Renewable Energy**
  - 1.7 MW of PV under construction

- **Technology Demonstrations**
  - SPIDERS microgrid & electric vehicle energy storage
  - Biomaxx CHP project, First Fuel energy auditing, & Melink kitchen hood w/VFDs

**1.7 MW consolidated PV site**

**Bi-directional vehicle charging stations**
Best Practices – Energy

- **Conduct thermal building envelope analysis**
  - IR thermography identifies heat loss & enables targeted repairs

- **Reduce energy use through energy management control systems (EMCS)**
  - Provides ability to control energy-consuming devices (e.g., fans, compressors, boilers, chillers, pumps, lights)
  - Can also be used for demand reduction

- **Hire resource efficiency managers (REMs)**
  - REM’s goal is to reduce consumption & cost of energy
  - Work with existing staff to enhance conservation efforts
Pursue alternative financing mechanisms

- Energy Savings Performance Contracts (ESPCs) & Utility Energy Service Contracts (UESCs)
  - The Energy Services Company (ESCO) or Utility Provider funds energy projects that are paid back with cost savings generated over the contract term or Power Purchase Agreement

Conduct energy master planning

- Integrates energy efficiency & renewable energy goals & planning into the Real Property Master Plan
- Enables renewable energy options that aren’t feasible at a single building (e.g., central utility plants to serve a Brigade complex)
Lessons Learned

- A motivated team from all levels & disciplines is needed
- Technology alone won’t achieve your energy goals – incentives, resources, & culture/behavior change are also needed
- Accurate data is essential for establishing baseline energy use
- Renewable energy assessments should focus on commercially available technologies
- Master planning & construction designs need to sync with net zero goals, & must consider water-waste tradeoffs
- Grid interconnections can be problematic; storage & microgrids may be needed to fully utilize renewable energy benefits
Army Net Zero Water
Net Zero Water

Net Zero Water: Reduce overall water use, regardless of the source; increase efficiency of water equipment; recycle and reuse water, shifting from 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, such that a Net Zero water installation recharges as much water back into the aquifer as it withdraws.

Holistic Approach Includes:
- Water conservation & efficiencies
- Water reuse strategies, including grey water & purple pipe where cost effective
- Water security & reliability strategies, including alternate water supplies
Net Zero – Water Balance

Water Balance = comparison of water supplied to water used

WATER USED BY FACILITY OR ACTIVITY (Kgal)

- Family Housing Plumbing, 195,000
- Family Housing Irrigation, 105,000
- Barracks Plumbing, 80,000
- On-Post Irrigation, 295,000
- Military Daytime Plumbing, 50,000
- Hospital, 25,000
- Civilian/Contractor Plumbing, 15,000
- Other, 20,000
- Distribution System Losses, 51,000
Net Zero Water Concept – Ft Riley

Fort Riley Potable Water Distribution System
789,000 Kgal

- WTP
- Well pumps

Misc. & Unaccounted Usage

- Family Housing Indoor
  218,000 Kgal
- Hospital Water Usage
  39,900 Kgal
- On-Post Plumbing & Laundry
  133,900 Kgal
- On-Post Irrigation (incl. golf courses)
  32,600 Kgal
- Dining
  28,900 Kgal

- Family Housing Irrigation
  35,600 Kgal
- Other Uses
  55,300 Kgal

- Vehicle Wash IVWF
  25,400 Kgal
- Industrial WWTP (Lagoons)
  39,400 Kgal

- Potential RCW

Custer Hill WWTP
Camp Funston WWTP
Potential RCW

Local Water Shed (Creek Beds)
Kansas River
Groundwater

Assistant Secretary of the Army (Installations, Energy & Environment)
Water Roadmaps

- Water Balance
  - Identify largest end-users
  - Set priorities

- Water Efficiency
  - Perform LCC analysis on measures
  - Rank order projects
  - Include technology and behavioral changes needed

- Roadmap Workshop
  - Collaborate with site
  - Set priorities
  - Identify funding
  - Determine acquisition strategy

- Roadmap and Master Planning
  - Finalize strategy
  - Incorporate into master planning

Ft Carson Water Roadmap
- Replaced potable water with process water for foam suppression at wastewater treatment plant
  - $1,200 investment saves 300,000 gallons/month
  - Payback period: 1 month

- Installed a water chiller to replace single-pass cooling system
  - $125,000 investment saves 2,000,000 gallons/month
  - Payback period: 8 months
Net Zero Water – Best Practices

- **Maximize the use of xeriscaping**
  - Turf irrigation is one of the most common water demands at Army installations
  - Camp Rilea, OR, converted turf to native meadows & rain gardens to reduce irrigation needs

- **Implement leak detection on the potable water distribution system**
  - Tobyhanna Army Depot, PA, implemented an aggressive metering & leak detection program resulting in 38% reduction in water use intensity
Water Best Practices (cont.)

- **Maximize water recycling**
  - Matching water quality to intended use

- **Install purple pipe**
  - Separating reclaimed water via installation of purple pipe system
  - Several pilot developing projects to design, plan, and install

- **Maximize use of alternate water sources**
  - Collect and use rain water for industrial cooling tower make up
  - Capturing stormwater for use in irrigation
Army Net Zero Waste
Net Zero **WASTE**: Reduce, reuse, recycle/compost, & recover solid waste streams, converting them to resource values, resulting in zero landfill disposal

**Holistic Approach Includes:**

- Improved purchasing practices (e.g., buy less; buy recycled & recyclable content; reduce packaging material)
- Recognition that waste is a resource (e.g., reuse centers, efforts to match users with donors)
- Increased recycling & composting
- Energy recovery *(after* reduction & diversion efforts have been implemented)

**Goal:** No solid waste disposal in landfills by FY2020
Waste Analysis & Divertability

Installation Level Municipal Solid Waste By Category, Percent by Volume

- Construction & Demolition Debris: 0%
- Whole End Items & Products: 1%
- Special Waste: 5%
- Metal: 4%
- Glass: 2%
- Wood: 3%
- Yard Trimmings: 5%
- Paper: 18%
- Plastic: 29%
- Corrugated Cardboard: 12%
- Mixed Office Paper: 8%
- Newspapers: 5%
- Other (Magazines, Targets, Phonebooks, etc.): 15%
- Organics: 8%
- Consumer Contaminated Waste: 33%

Waste Diversion Potential (% waste by mass)

- Diverted: 14%
- Opportunity: 17%
- Underutilized Program: 43%
- Problem: 26%

37% of trash can be recycled NOW!

Fort Bliss - Hospital (Including DFAC/Kitchen)

Score | Short Description | Long Description
--- | --- | ---
1 | Diverted | Diversion program is in place and estimate at least 90% compliance.
2 | Underutilized Program | Diversion program is in place, but less than 90% compliance.
3 | Opportunity | Diversion possible through adoption of existing technologies, infrastructure, markets, etc.
4 | Challenge | Diversion possible, but will require additional development of available technologies, infrastructure, and/or markets.
5 | Problem | Diversion would require development of new technologies, infrastructure, and/or markets.
0 | Incomplete Information | Incomplete information about presence and/or destination of waste stream.

No Waste: Waste stream does not exist for this organization.
Net Zero Waste Roadmaps

A comprehensive program starts at the top of the hierarchy

- Material flow analysis
- Improved procurement practices
- Re-purpose / re-use strategy
- Recycling & composting strategy
- Potentially viable technologies

Example Installation Waste Profile

<table>
<thead>
<tr>
<th>Year</th>
<th>Tons of Waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>180,000</td>
</tr>
<tr>
<td>2012</td>
<td>160,000</td>
</tr>
<tr>
<td>2013</td>
<td>140,000</td>
</tr>
<tr>
<td>2014</td>
<td>120,000</td>
</tr>
<tr>
<td>2015</td>
<td>100,000</td>
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</tbody>
</table>

- Green packaging
- Waste-to-Energy
- Recycling
- Landfill disposal

Net Zero Waste – Fort Carson

- Green procurement program
- Reuse efforts
  - Furniture donation program (target: used barracks & office furnishings)
  - Soil & aggregate from construction sites
  - Porcelain collection with city
- Recycling efforts
  - Electronics recycling via UNICOR
  - Recycling incentives for units
Best Practices – Waste

- **Establish a Qualified Recycling Program (QRP)**
  - Enables installations to receive proceeds from recyclables sales
  - Proceeds can be invested in other recycling efforts & Morale, Welfare & Recreation activities

- **Characterize & quantify waste flows**
  - Quantifies waste types & volumes
  - Identifies waste streams for elimination, minimization, or diversion

- **Improve purchasing practices to reduce waste at the source**
  - Eliminate excess packaging
  - Require take-back policies
  - Require recyclable content

*Assistant Secretary of the Army (Inst)*
• Repurpose & reuse waste/material through free & low-cost opportunities
  – Establish re-use centers for furnishings, equipment, etc.
  – Donate excess used furniture to non-profits
  – Work with non-profits (e.g., Habitat for Humanity) to recover usable building components prior to demolition
  – Reuse textiles for other uses (e.g., use old hospital linens at Vet Clinic)

• Recycle & compost waste through free & low-cost opportunities
  – Partner with non-profits (e.g., UNICOR) to collect & dispose of personal electronics
  – Look for city / regional collection efforts
Collaboration, Integration & Next Steps in Army Net Zero
Internal Collaboration

- Continue to share & document successes
  - Sierra AD’s partnering with local utility provider
  - Tobyhanna’s water reuse efforts
  - Fort Bliss’s electronics recycling
  - Fort Carson’s furniture donations
  - Many others

- Assist with challenges

- Build cross-functional Net Zero teams

- Monthly collaboration calls

- Periodic progress meetings
External Collaboration

Installations won’t succeed without collaboration!

- Federal government:
  - Dept. of Energy: FEMP, NREL & PNNL
  - Environmental Protection Agency
  - General Services Administration
  - U.S. Army Corps of Engineers

- Local & regional:
  - City & county utility & waste providers
  - Regional authorities
  - Non-profit & Veterans organizations

- Public-private partnerships
Integration

- **Updates to Real Property Master Plans**
  - Integrates energy, water & waste concepts (e.g., central utility plants, micro-grids, better siting)

- **Sustainable design policy update**
  - Adopts ASHRAE 189.1-2011 & new DoD Unified Facility Standard 1-200-02
  - Continues certification via LEED
  - Increases emphasis on sustainable building materials & facility recycling
  - Includes Net Zero energy, water, & waste strategies
    - Energy efficiency & renewables
    - Xeriscaping & water reuse
    - Waste minimization & recycling

Fort Bragg, NC LEED Platinum
Community Emergency Services Station
Implementing NZ Army-wide

The Army’s intent is that all installations evaluate the feasibility of achieving Net Zero & then implement Net Zero to the maximum extent practical & fiscally prudent

- Army-wide implementation:
  - Issue Army-wide Net Zero policy
  - Identify & institutionalize best practices
  - Publish Garrison Commanders’ implementation guide
Next Steps

- Installation templates:
  - Pilot Installation Assessments & Roadmaps
  - Integrated Energy-Water-Waste Roadmap
  - Integrated Energy-Water Security Assessment

- Progress reporting
  - Net Zero Progress Report*
  - Create publically-releasable reports:
    - Water Balance Assessment summaries
    - Net Zero Energy summaries

Questions?

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