



# Army Net Zero Initiative

*Presented at  
Federal Facilities Council Meeting  
20 February 2014*

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(Energy & Sustainability)



# Agenda



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



# Army Resilience

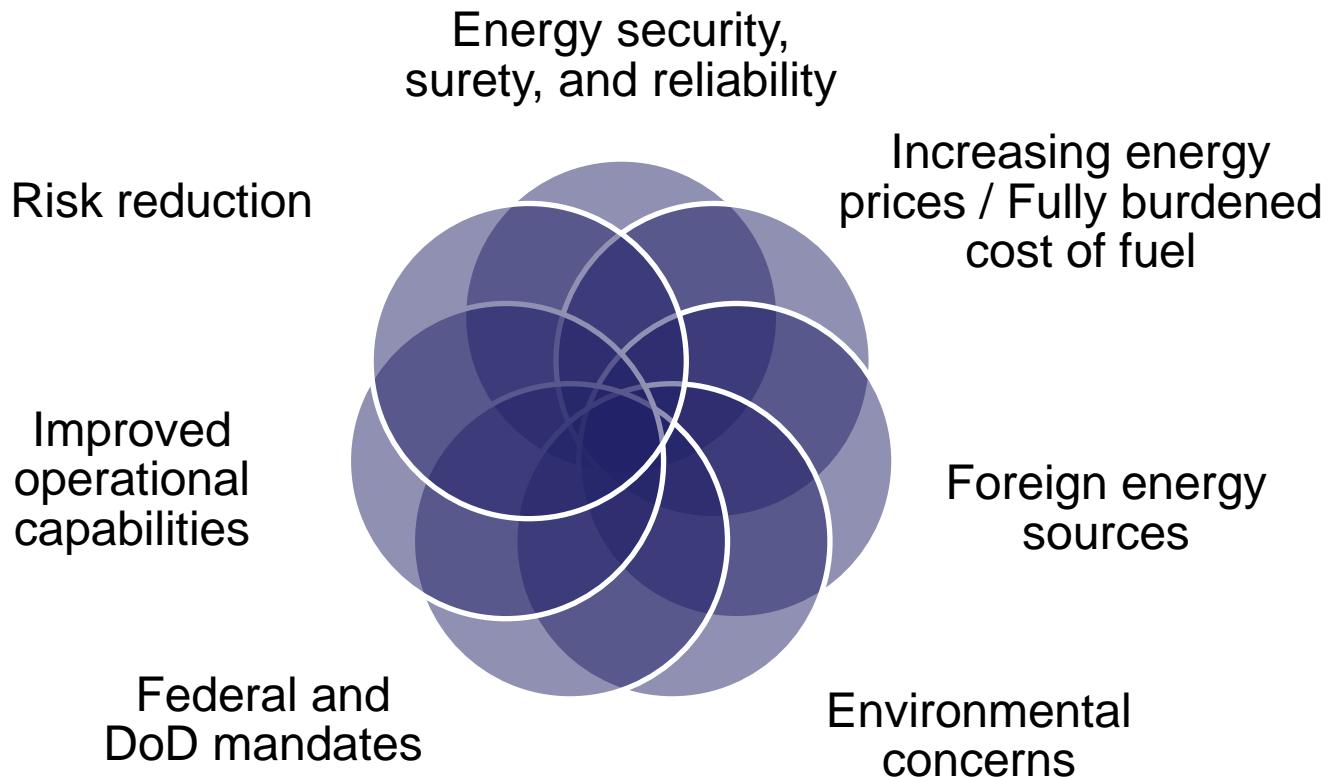


- Resilience: perform all missions under a variety of adverse conditions
- Applies to people & organizations
- Army installations must be resilient in order to carry out their mission:
  - Indirect: Fukushima, Japan
  - Direct: Fort Leonard Wood, MO; Fort Bragg, NC
- Net Zero strategies improve resilience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





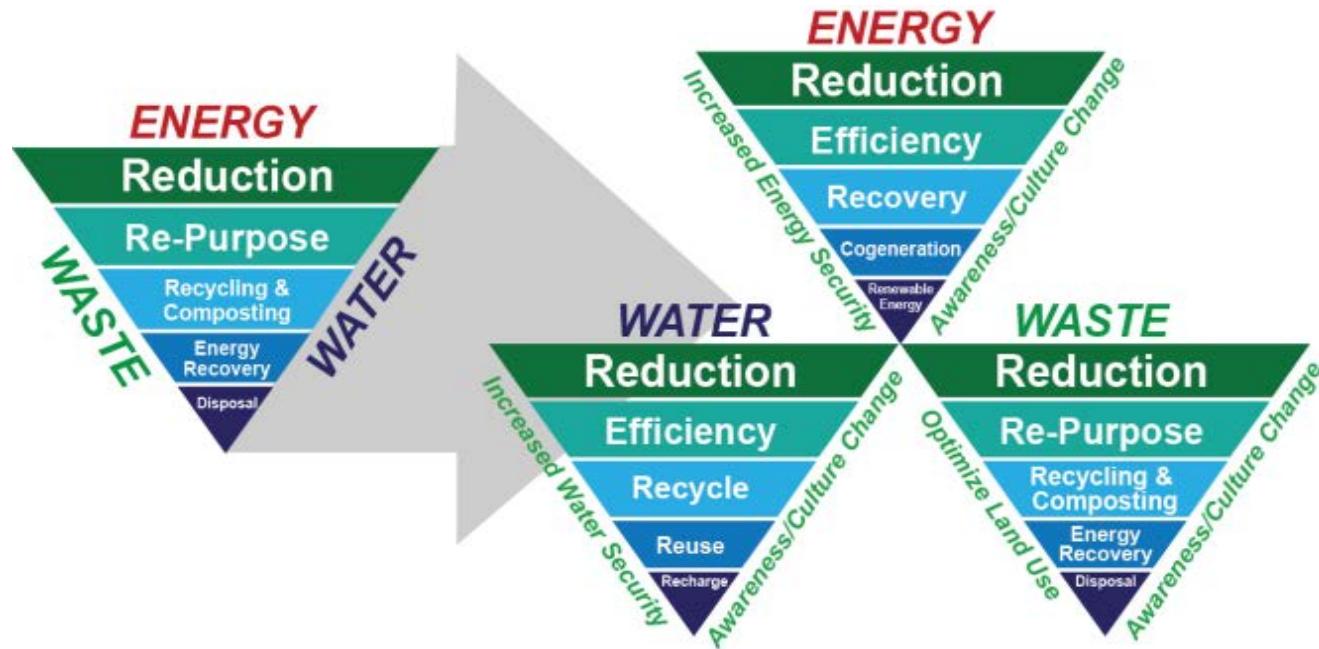
# Drivers of Change



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



# Net Zero Overview



## 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

Tobhanna Army Depot

West Point

## State-Wide Pilot:

Oregon Army National Guard





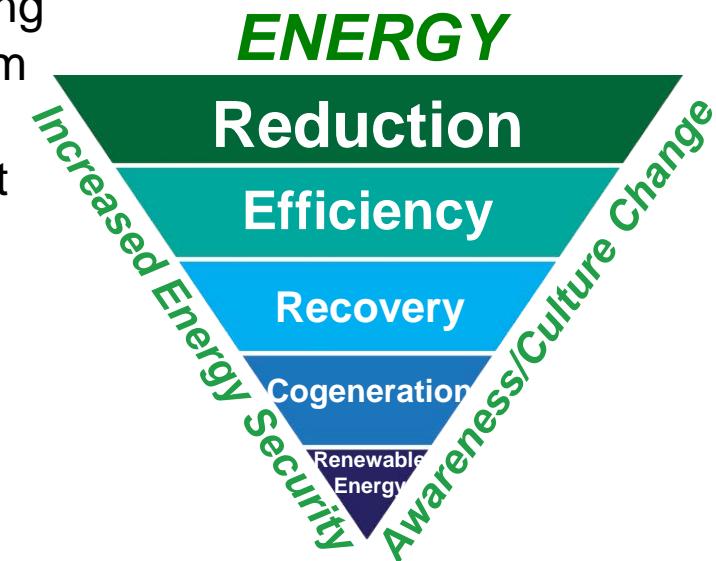
# Army Net Zero Energy



# 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



Energy Auditing

## ▪ Assessing the potential

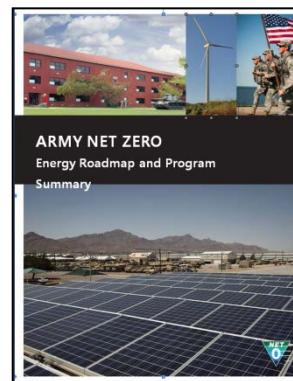
- Conducted renewable energy audits at Net Zero energy pilot installations
- Identified opportunities for small and large-scale renewables
- Coordinating with the Energy Initiatives Task Force for projects >10MW



Potential Solar PV Site

## ▪ 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



Assistant Secretary of the Army (Int'l) Energy Initiatives

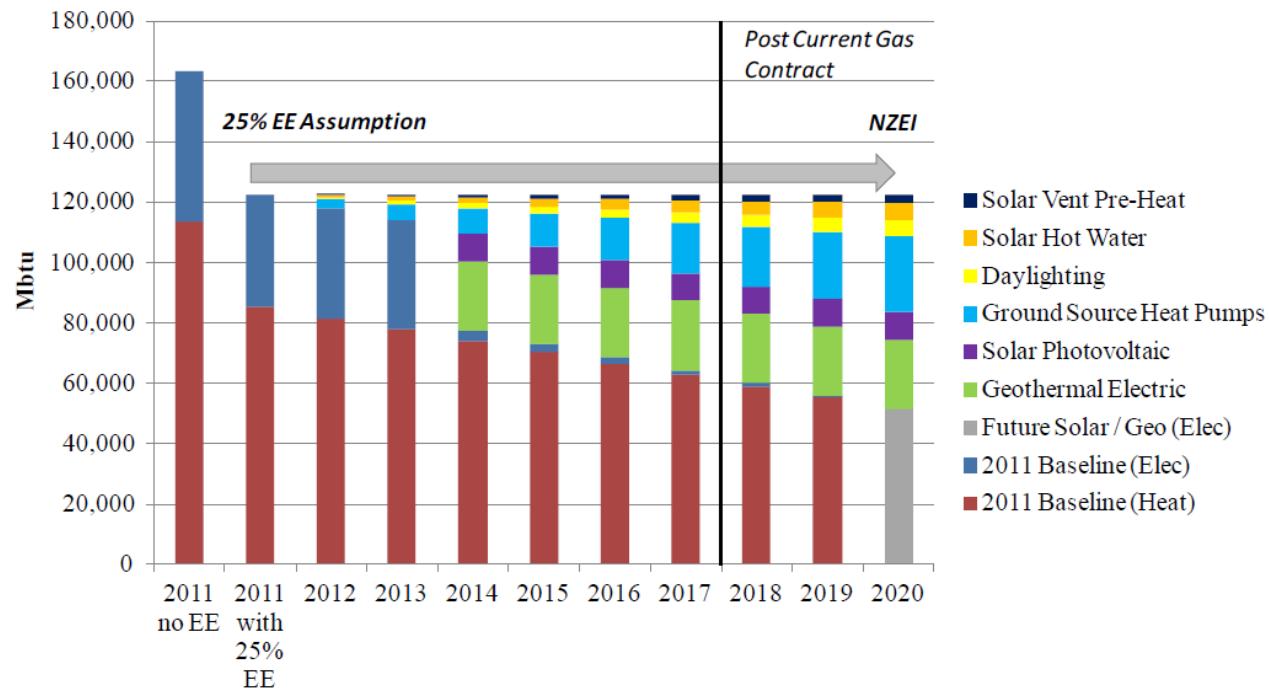
Energy Roadmap Summary



# 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





# Net Zero Energy Summary



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

\*

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
- 3<sup>rd</sup> 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

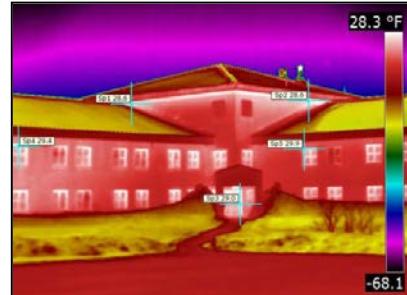


Bi-directional vehicle charging stations



# 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



Troop Barracks



EMCS Dashboard



Oregon NG REM



# Best Practices – Energy (cont.)

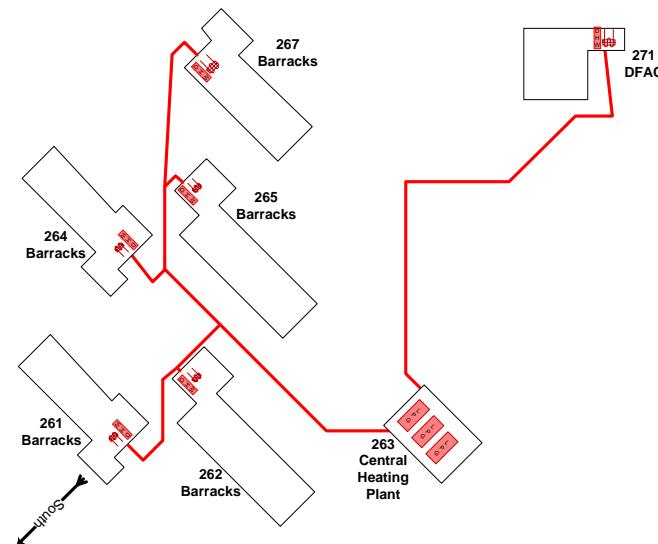


## ▪ Pursue alternative financing mechanisms

- 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)

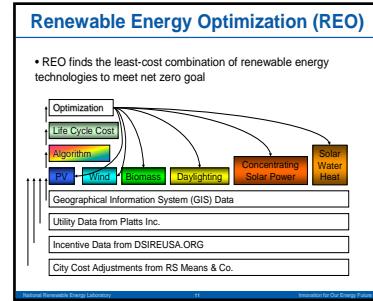




# Lessons Learned



- 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



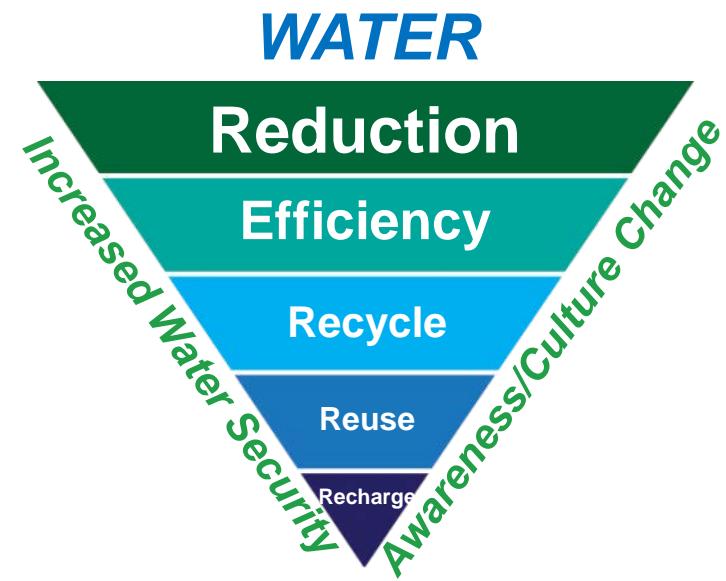


# Army Net Zero Water



# 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



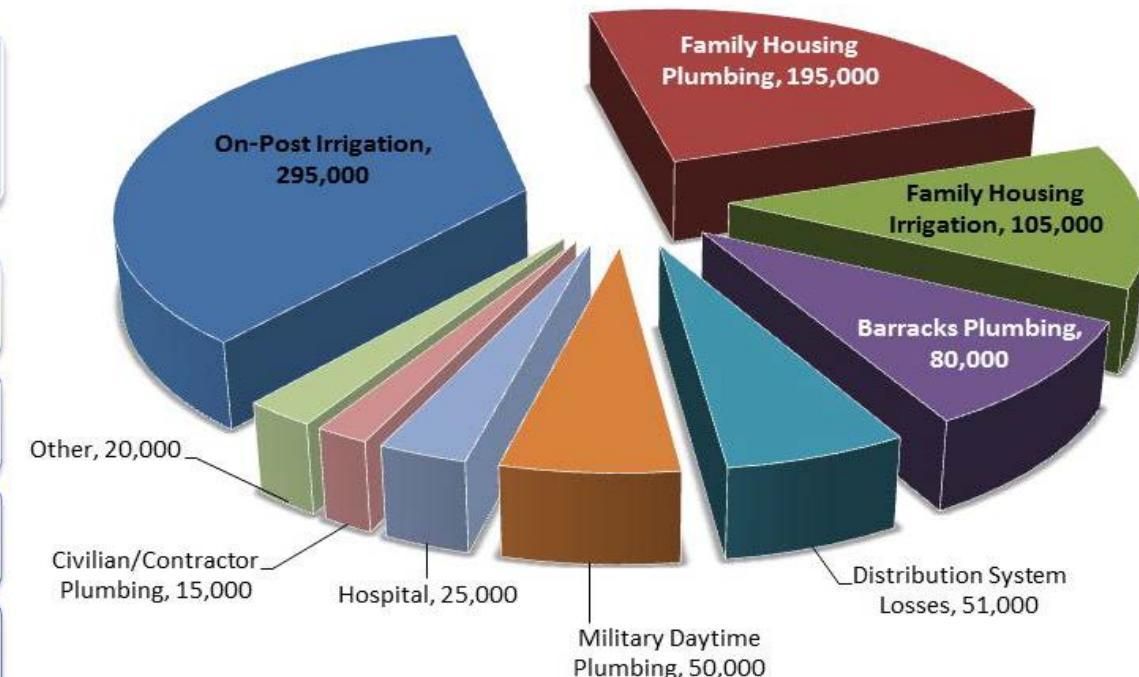
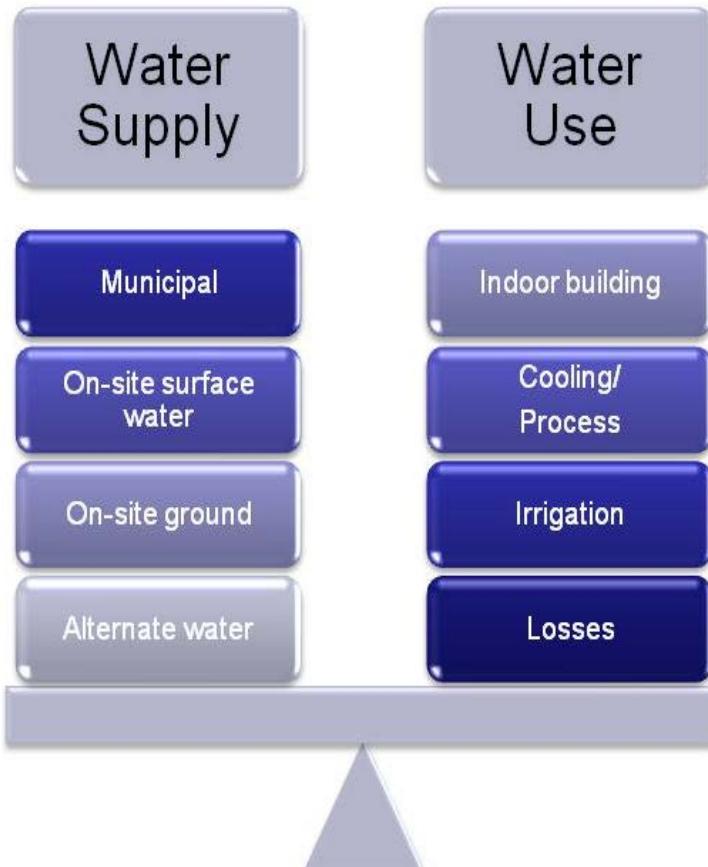
## Holistic Approach Includes:

- 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

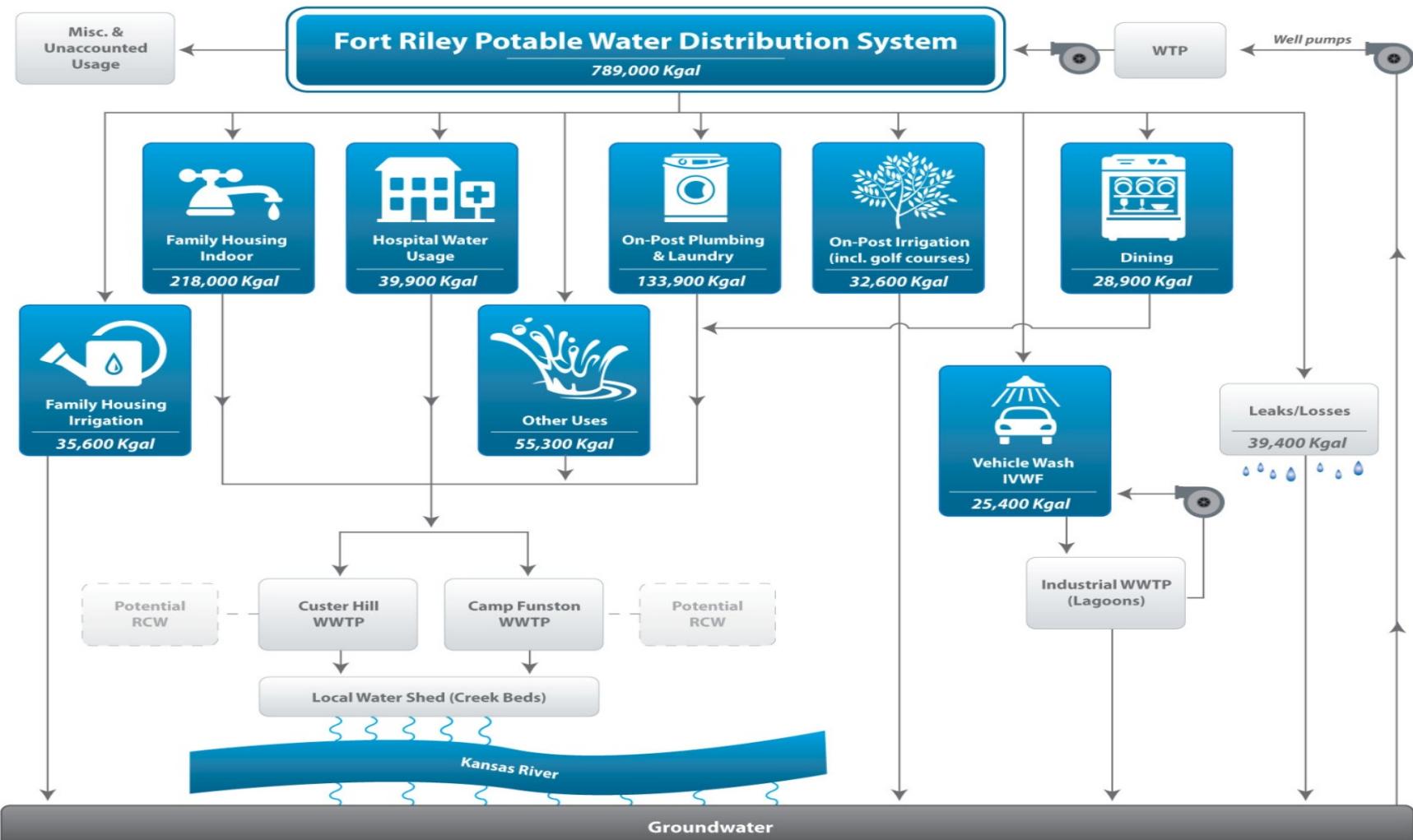
Water Balance = comparison of water supplied to water used



WATER USED BY FACILITY OR ACTIVITY (Kgal)



# Net Zero Water Concept – Ft Riley





# 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

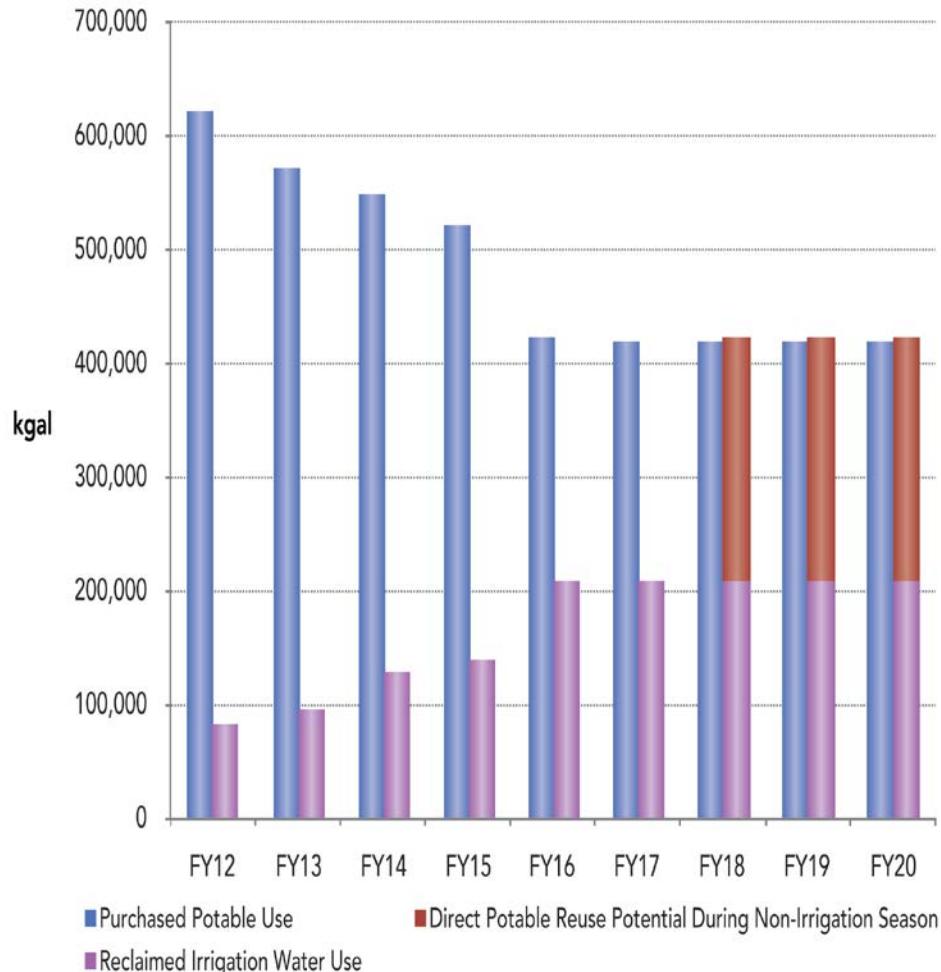
## ■ Roadmap Workshop

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

## ■ Roadmap and Master Planning

- Finalize strategy
- Incorporate into master planning

## Ft Carson Water Roadmap





# Net Zero Water – Tobyhanna AD

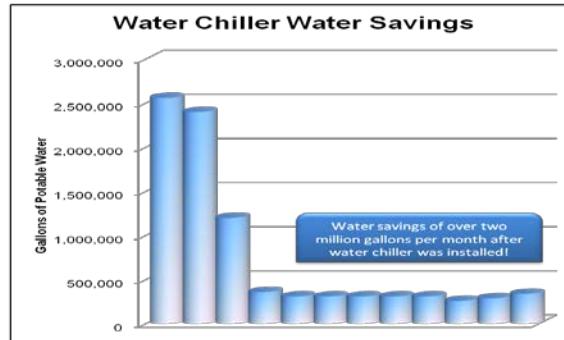


- **Replaced potable water with process water for foam suppression at wastewater treatment plant**

- \$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

### Synthetic Turf Conversion



### Xeriscape Conversion



# 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

Vehicle Wash Stations



Alternative water source



# Army Net Zero Waste



# 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., re-use centers, efforts to match users with donors)
- Increased recycling & composting
- Energy recovery (after reduction & diversion efforts have been implemented)



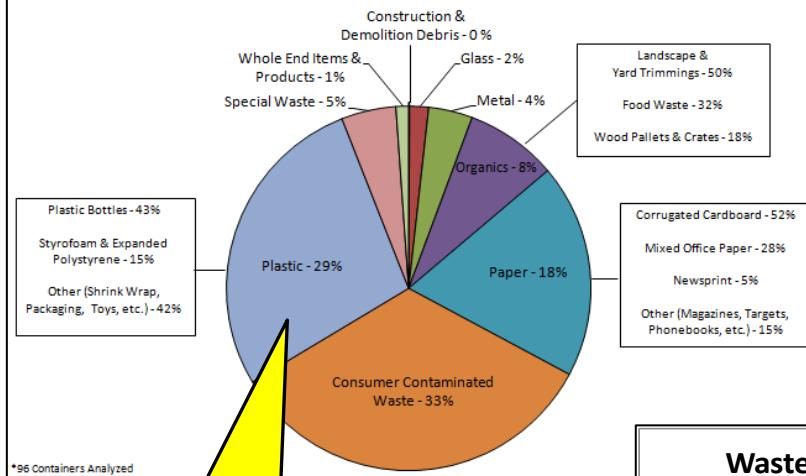
**Goal: No solid waste disposal in landfills by FY2020**



# Waste Analysis & Divertability

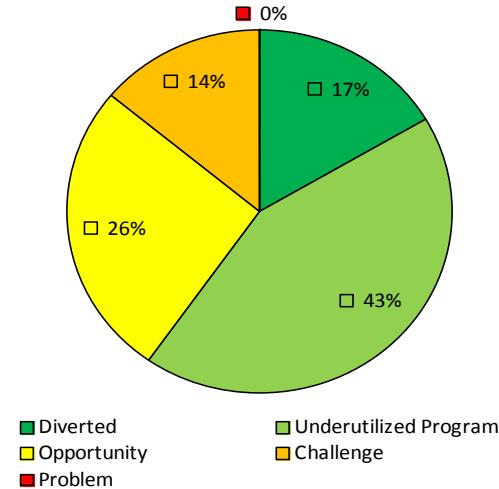


Installation Level Municipal Solid Waste By Category,  
Percent by Volume

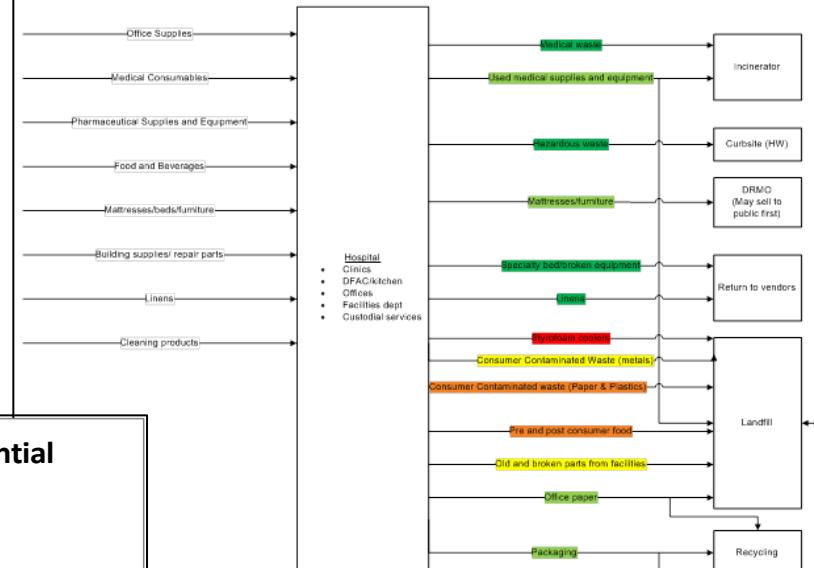


37% of trash can  
be recycled NOW!

Waste Diversion Potential  
(%waste by mass)



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



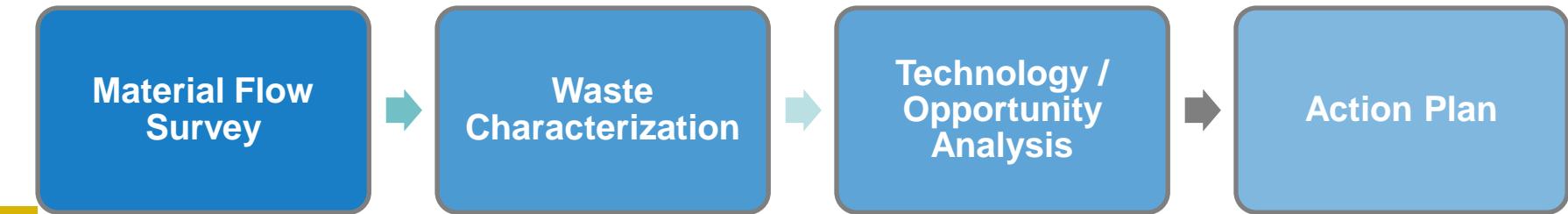
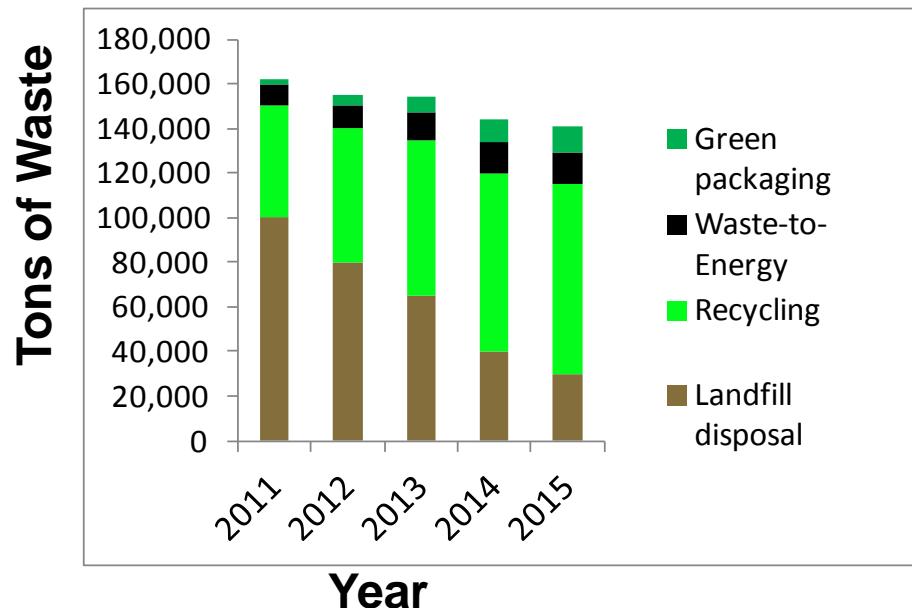
# Net Zero Waste Roadmaps



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





# Net Zero Waste – Fort Carson



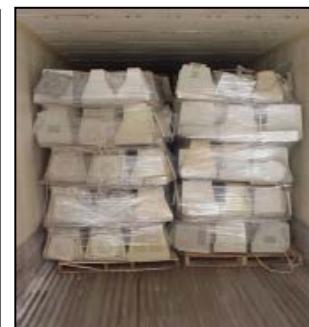
- **Green procurement program**

- **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



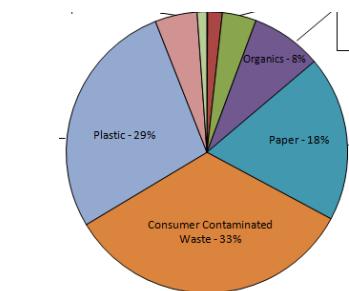


# Best Practices – Waste



- **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

Fort Hood  
recycling center





# Best Practices – Waste (cont.)



## ▪ 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)



End-of-Life furniture



Goodwill  
Industries International, Inc.



Habitat  
for Humanity



Electronics recycling  
via UNICOR

## ▪ 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 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

**Net Zero Water – Tobyhanna AD**

- 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
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Elements of Net Zero Water

Water conservation & efficiencies
Water reuse
Water security

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**Net Zero Energy – Fort Hunter Liggett**

- Reduced energy intensity by 40% (FY2003-2010)
  - Behavioral changes
  - Implemented low-demand technologies
  - Energy-efficient new construction
- Constructing a 1 MW solar power system
  - Funded by Energy Conservation Investment Program
  - Will produce 1,500 MWh annually
  - Will provide 12% of the installation's energy
- 2nd 1 MW solar system in development

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**Net Zero Waste – Joint Base Lewis-McChord (JBLM) Concrete and Asphalt Recycling**

A Net Zero Waste installation reduces, reuses, and recycles waste streams, converting them to reusable products that are then used to dispose to landfill over the course of a year.

In support of its Net Zero Waste Installation goals, JBLM has developed a new concrete and asphalt generated from in-house projects. The new concrete is a high-quality DOT specification aggregate for paving and concrete applications. The cost of offsite transportation and disposal are significantly reduced for the rock-aggregate. The cost of using reclaimed material is dependent on the volume of material used, but is 20% to 30% less than the cost of virgin material.

The use of reclaimed aggregate qualifies for LEED v4.0 credit points. JBLM also meets the Army's sustainable design and development goals for construction and facility renovations.

Contribution to Net Zero

- Eliminates disposal of waste concrete and asphalt
- Reduces cost for new aggregate
- Reduces fuel use for transport of new aggregate or disposal of waste aggregate

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# 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 34



# 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



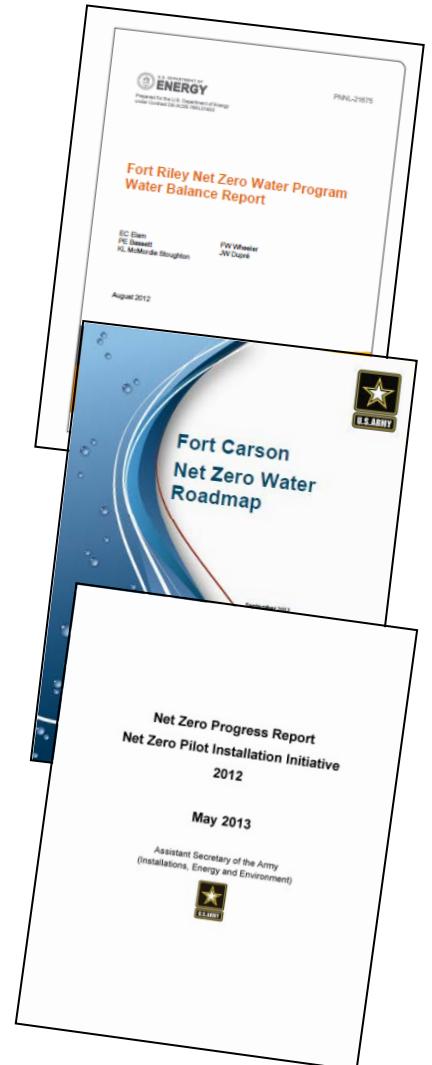
## ■ Installation templates:

- 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

\*[http://www.army.mil/article/103842/Army\\_releases\\_2012\\_Net\\_Zero\\_Progress\\_Report](http://www.army.mil/article/103842/Army_releases_2012_Net_Zero_Progress_Report)





# Questions?

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