



# 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

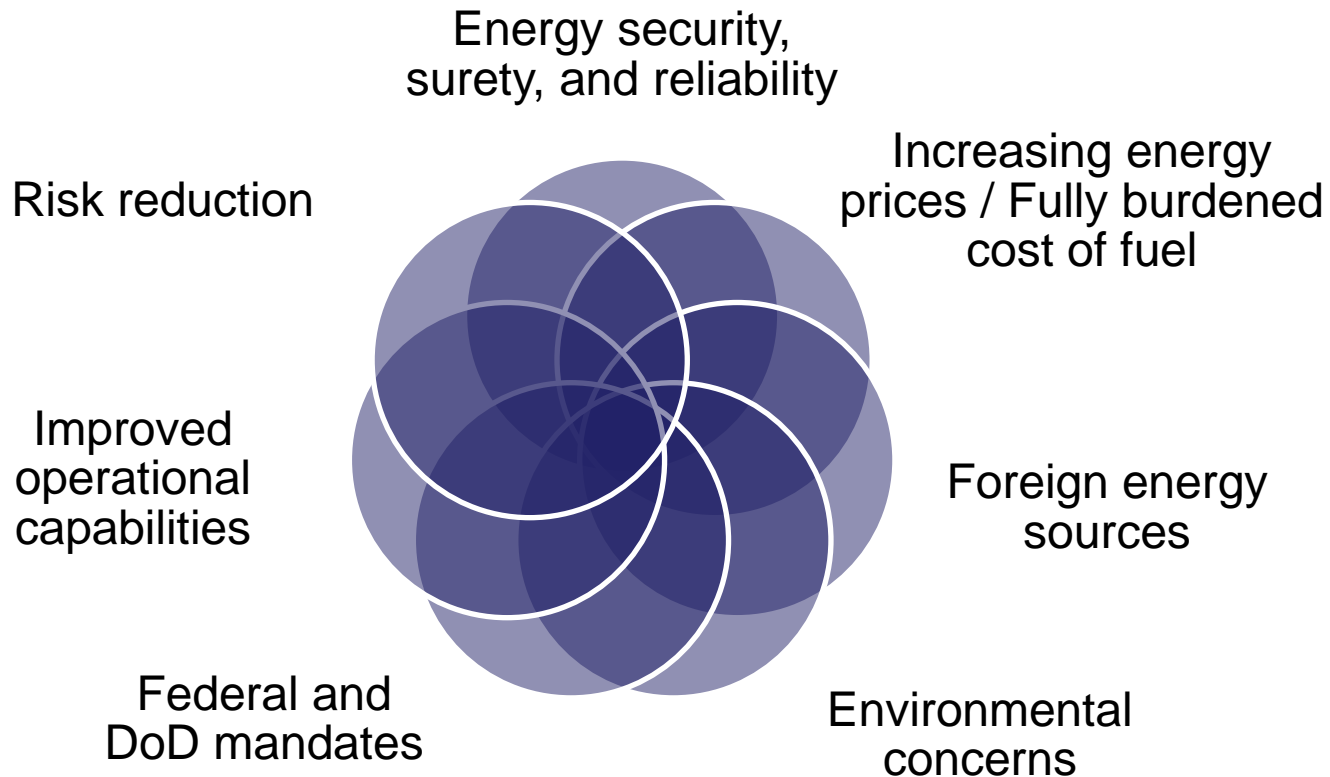


- Resilience: perform all missions under a variety of adverse conditions
- Applies to people & organizations
- Army installations must be resilient in order to carry out their mission:
  - Indirect: Fukushima, Japan
  - Direct: Fort Leonard Wood, MO; Fort Bragg, NC
- Net Zero strategies improve resilience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





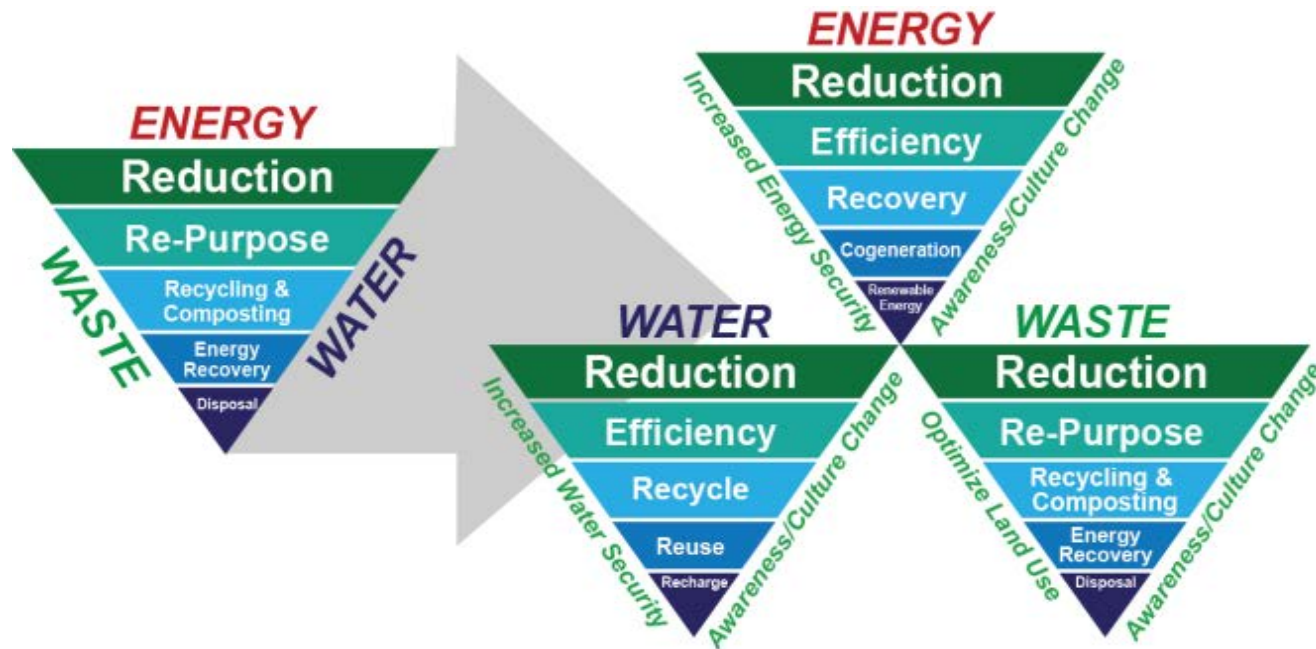
# Drivers of Change



**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  
Tobyhanna Army Depot  
West Point

## State-Wide Pilot:

Oregon Army National Guard





# Army Net Zero Energy



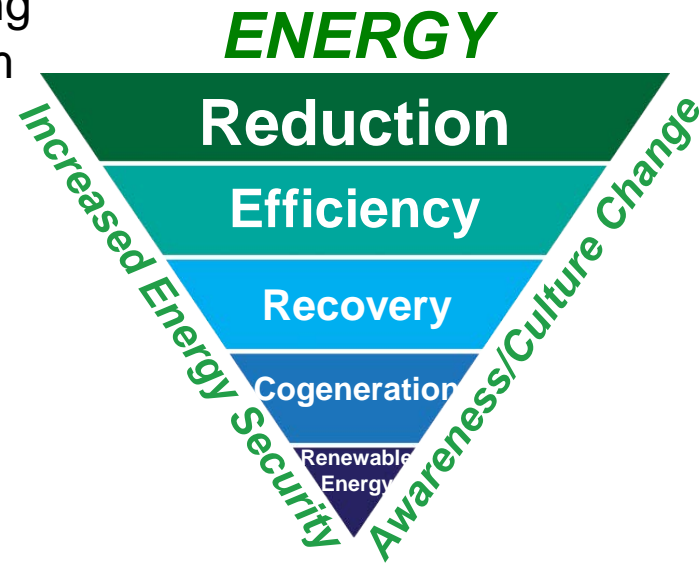
# Net Zero Energy



**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

## ■ 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

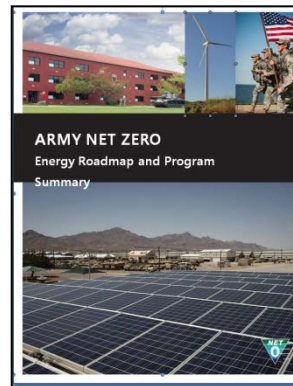
- Completed Net Zero 2020 roadmaps for energy with project lists & actions to implement over the next 7 years
- Developing programming documents for energy conservation & other funding programs



Energy Auditing



Potential Solar PV Site



Energy Roadmap  
Summary

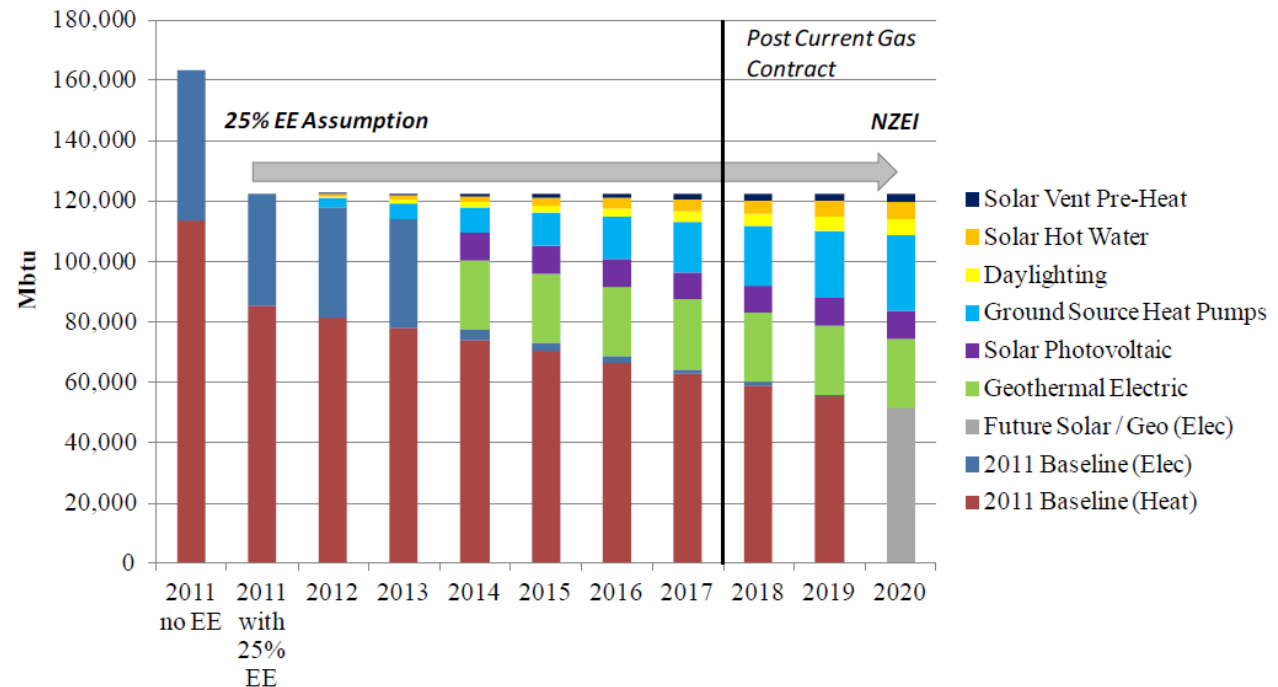


# Energy Roadmaps



- 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
Camp Parks	31%	86%	100%	96%
Ft. Bliss	15%	46%	100%	78%
Ft. Carson	17%	93%	100%	96%
Ft. Detrick	20%	45%	71%	76%
Ft. Hunter Liggett	38%	100%	100%	100%
Kwajalein	25%	NA (all electric)	83%	83%
Oregon NG	47%	100%	100%	100%
Sierra AD	25%	100%*	100%	100%
West Point	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



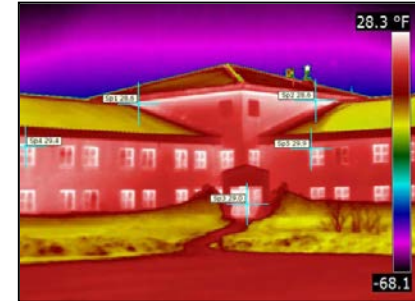
Bi-directional vehicle charging stations



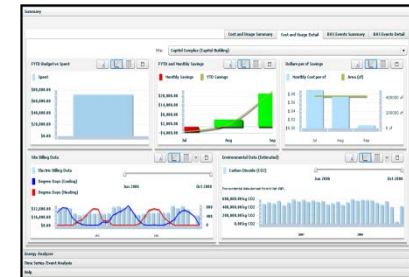
# Best Practices – Energy



- **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.)

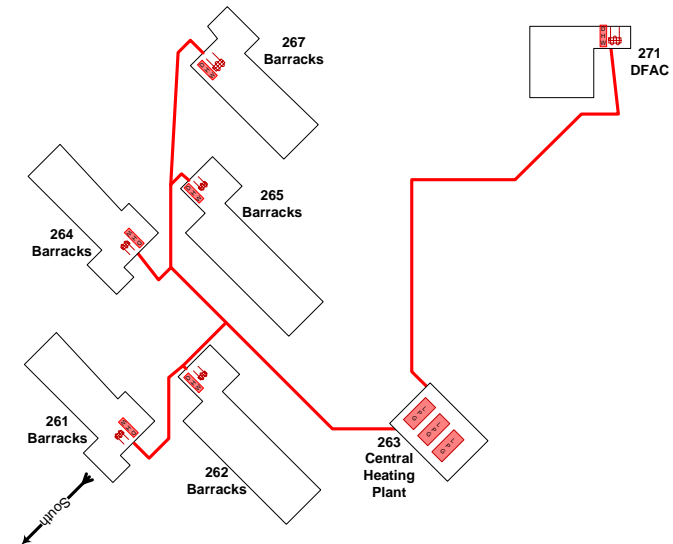


## ■ Pursue alternative financing mechanisms

- 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)



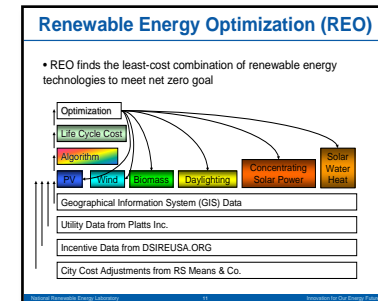




# Lessons Learned



- 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



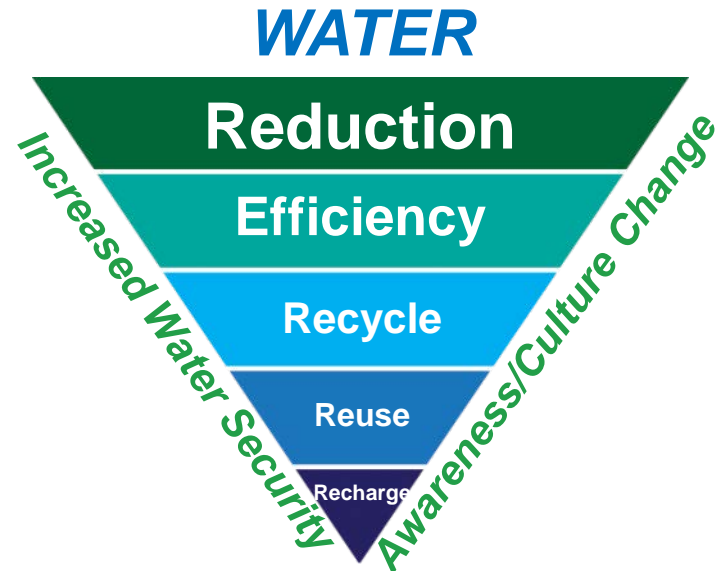
# Net Zero Water



**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

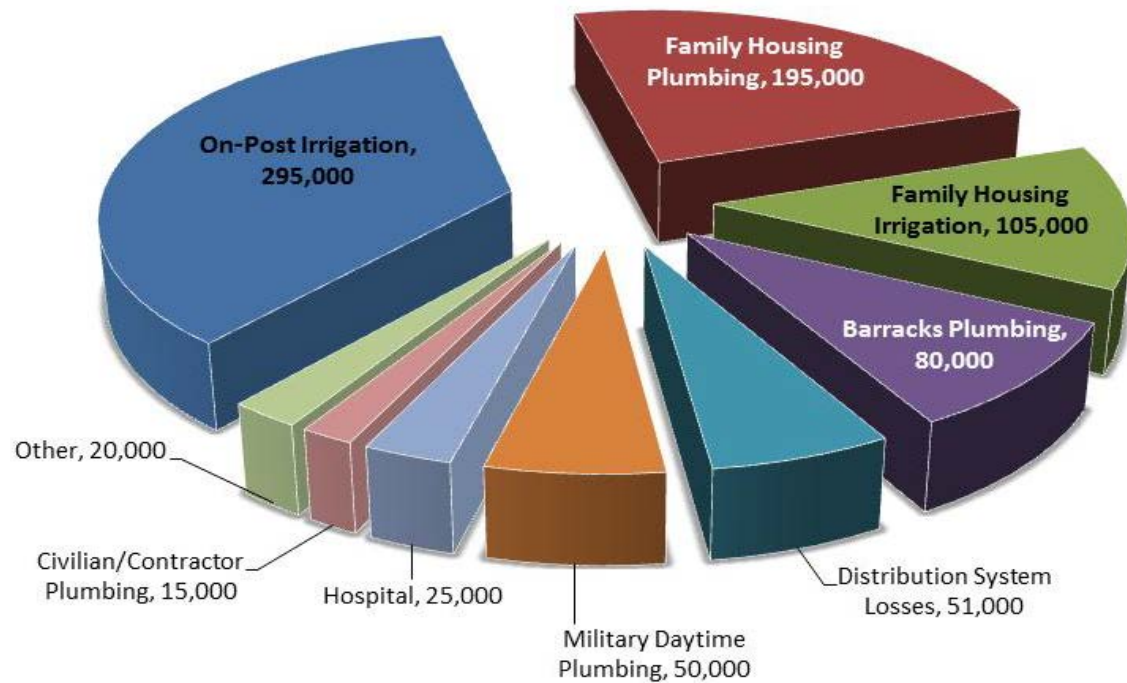
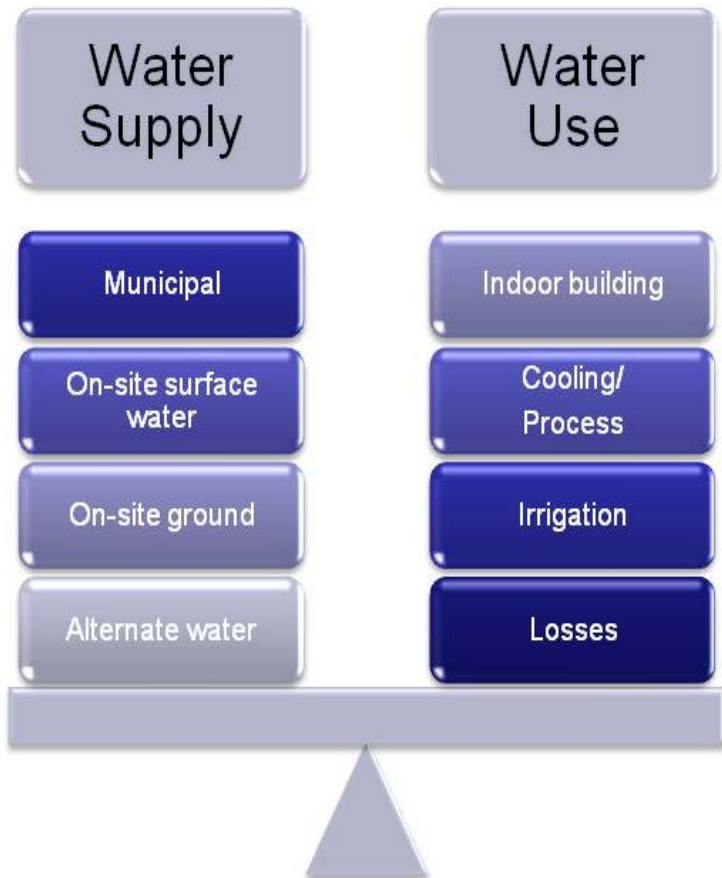




# Net Zero – Water Balance



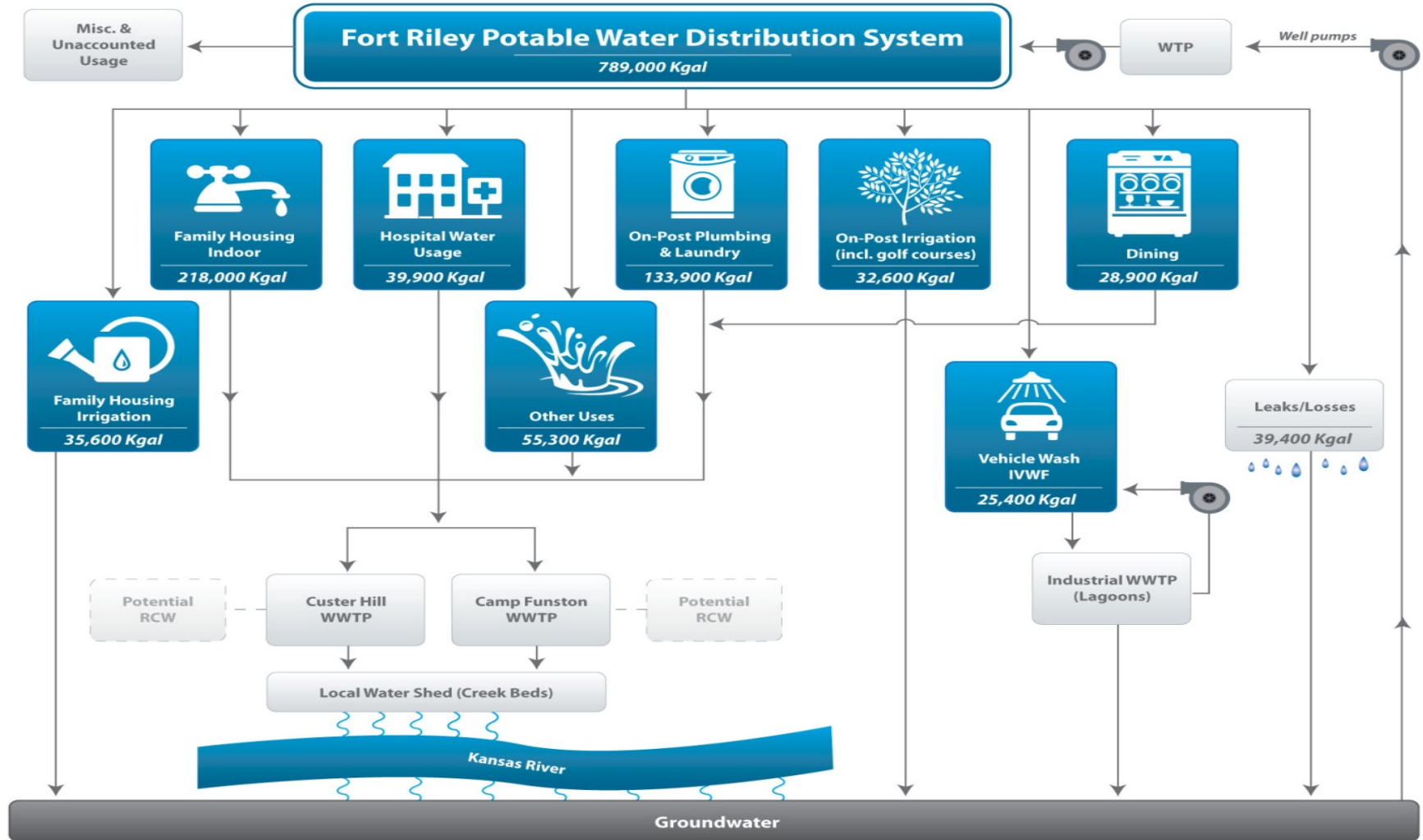
Water Balance = comparison of water supplied to water used



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

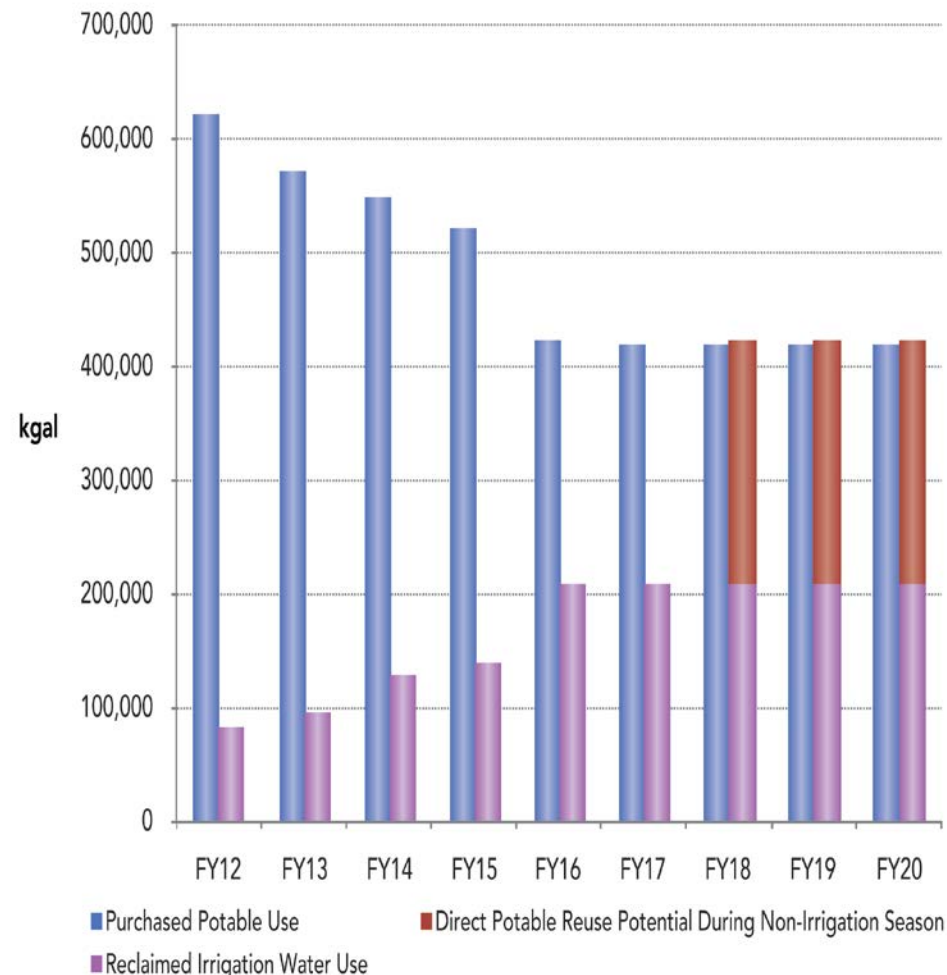
## ■ Roadmap Workshop

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

## ■ Roadmap and Master Planning

- Finalize strategy
- Incorporate into master planning

### Ft Carson Water Roadmap



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

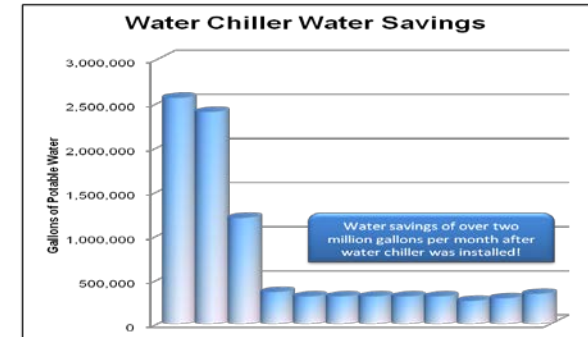
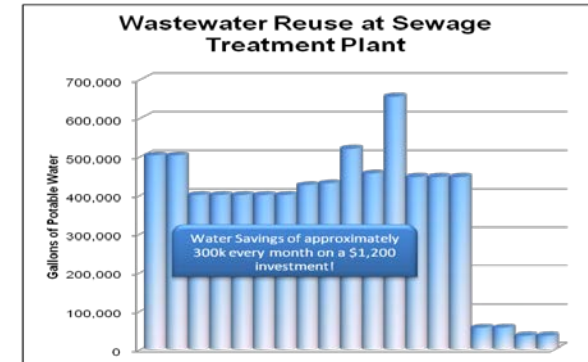




# Net Zero Water – Tobyhanna AD



- **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)



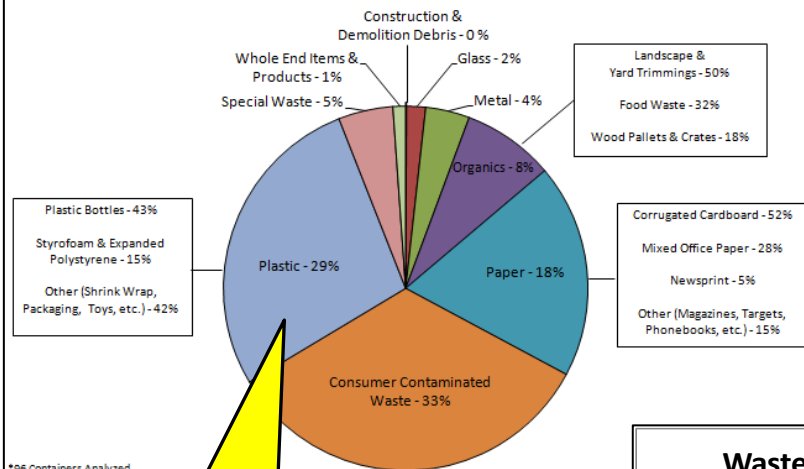
**Goal: No solid waste disposal in landfills by FY2020**



# Waste Analysis & Divertability

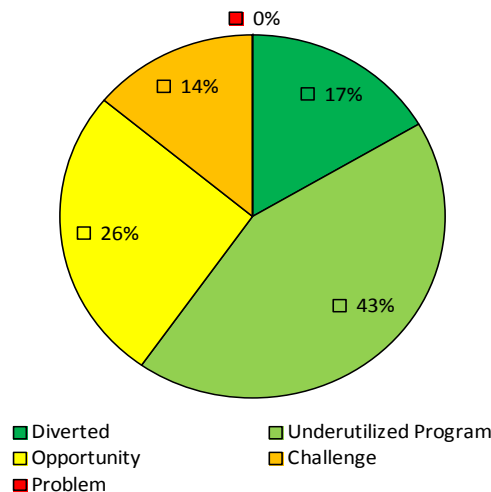


**Installation Level Municipal Solid Waste By Category, Percent by Volume**

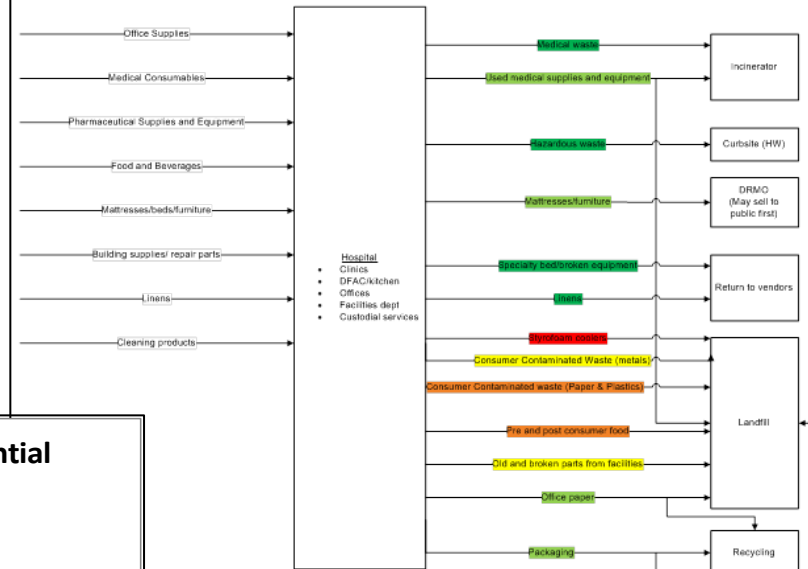


**37% of trash can be recycled NOW!**

**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





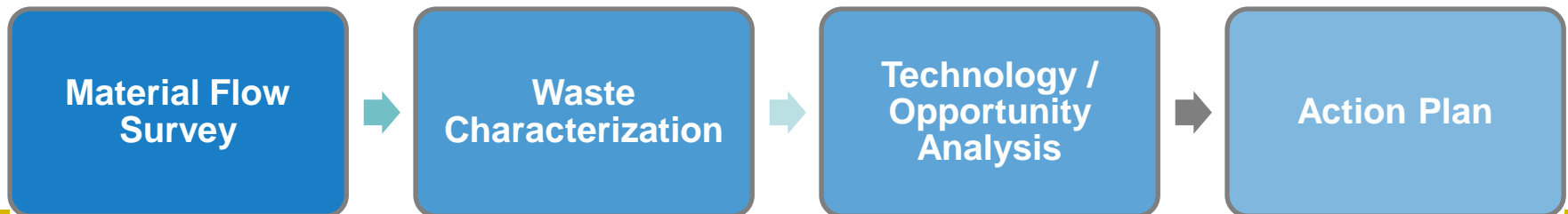
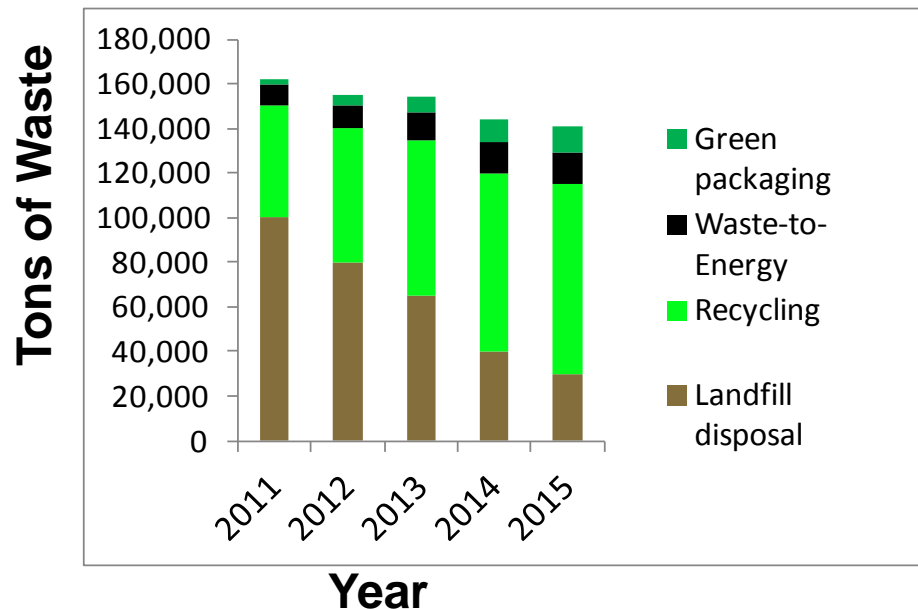
# Net Zero Waste Roadmaps



## 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



Assistant Secretary

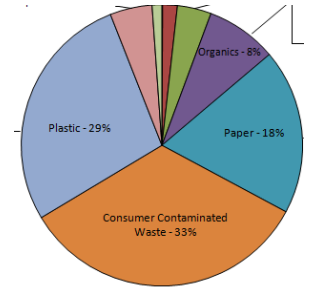


# Best Practices – Waste



- **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

## ■ 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



Electronics recycling  
via UNICOR



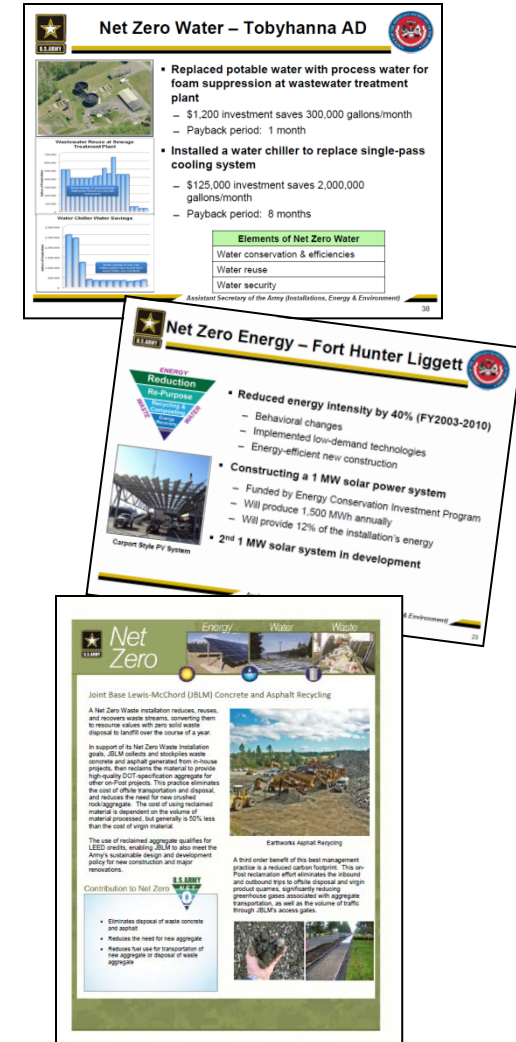
# Collaboration, Integration & Next Steps in Army Net Zero



# 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





# 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



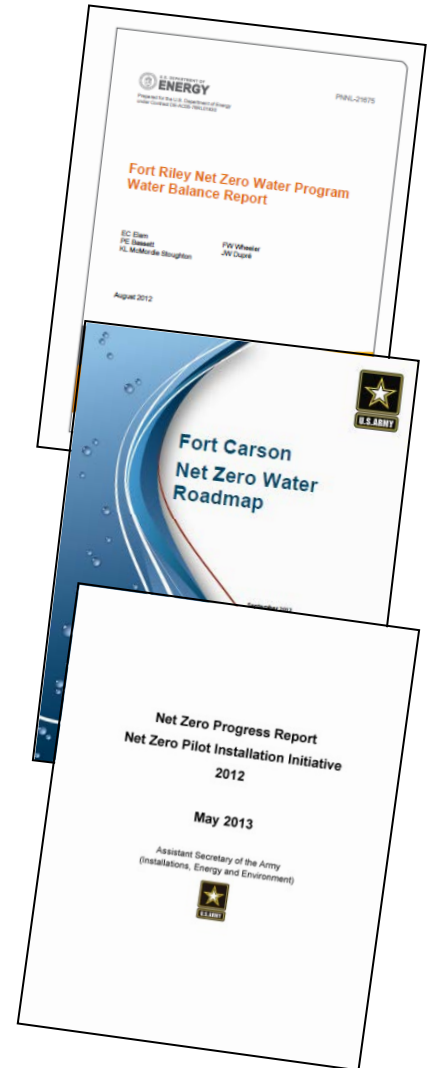


# Next Steps



- **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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