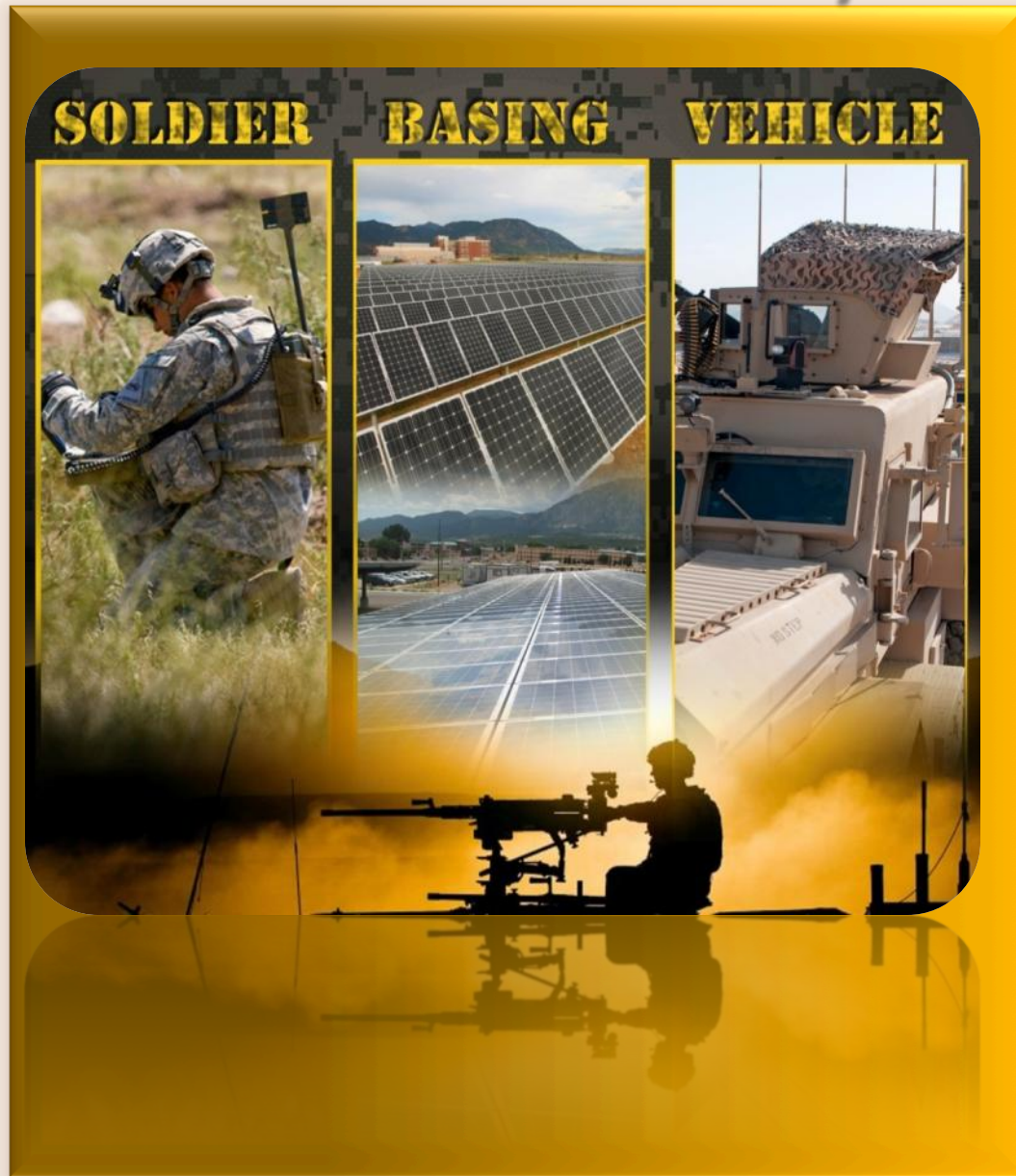


# Army NetZero



## Federal Utility Partnership Working Group Seminar

Mark Mahoney  
Director, Army Regional Environment  
and Energy Office - West

Assistant Secretary of the Army  
(Installations, Energy & Environment)  
14 January 2014

# 2013 Army Universe

(Data collected as of 30 Sep 12)

## Land Acreage

• United States	13,428,541
• Europe	133,907
• Asia	22,816
• Other Overseas	1,361

## Roads (paved and unpaved)

- 9,611 Lane Miles

## Paved Area (excludes roads)

(Square yards)

- 255,800,227

## Railroads

- 2,347 (Miles)
- 29,336 (LF (Bridges))

## Buildings

(Square feet)

• United States	776,864,319
• Europe	105,915,310
• Asia	41,899,139
• Other	3,210,417
• Leased	40,955,967
• Privatized	

## Utilities (Miles)

- (Electric, Gas, Water, Sewer)
- 45,308

## Army Installations

• IMCOM	66
• Army Reserve	3
• AMC	27
• DLA	5
• National Guard	48
• ARCENT	3

TOTAL 152

## FY12 Army Demographics

**59.8% total married**  
**(8.7% dual military married)**  
**6.6% single parents**  
**880,743 family members**

## Environmental Clean-up Remaining

(Installation Restoration Program & Military Munitions Response Program)

• Active Sites	1,515
• BRAC Sites	310
• Formerly Used Defense Sites	1,738

## Army End-Strength

• Active	550,064
• USAR	201,166
• ARNG	358,078
• Civilians	1271,794
• Retired	865,117

**2.2 Million People**

## Aviation

• Multi-use	60
• Heliport	28

## Family Housing Units

• Owned	15,281
• Leased	7,945
• Privatized	83,625

**106,00 Homes**

## Barracks

Adequate Spaces	
• Permanent Party	148.4K
• Training	71.8K
• ORTC	106.3K

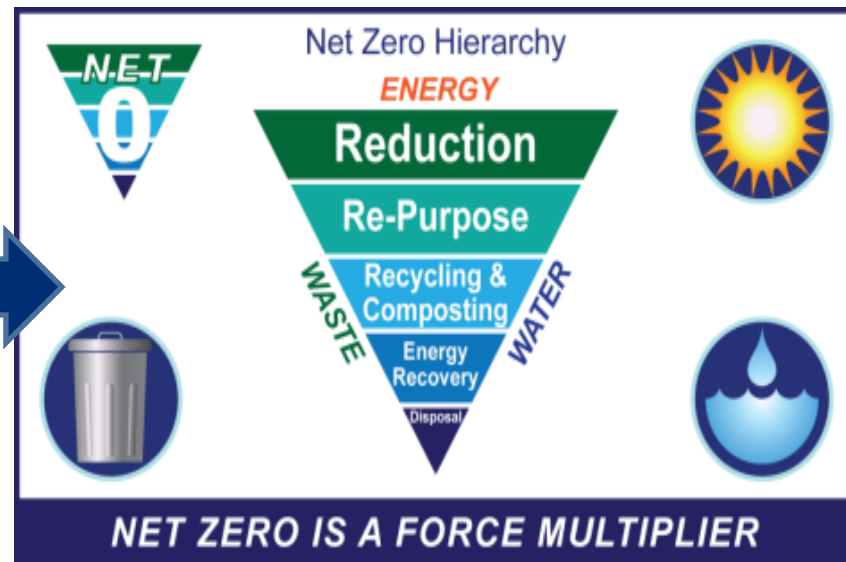
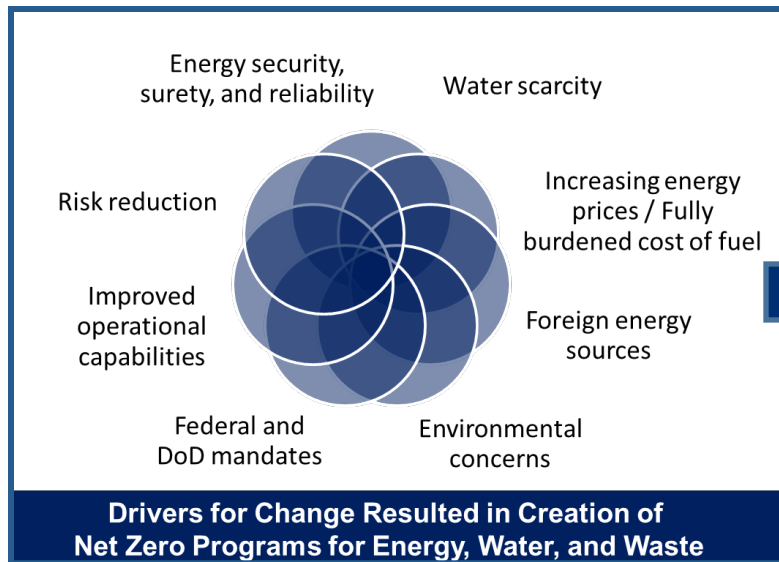
## Plant Replacement Value

- \$314.6B

**968 Million Square Feet**

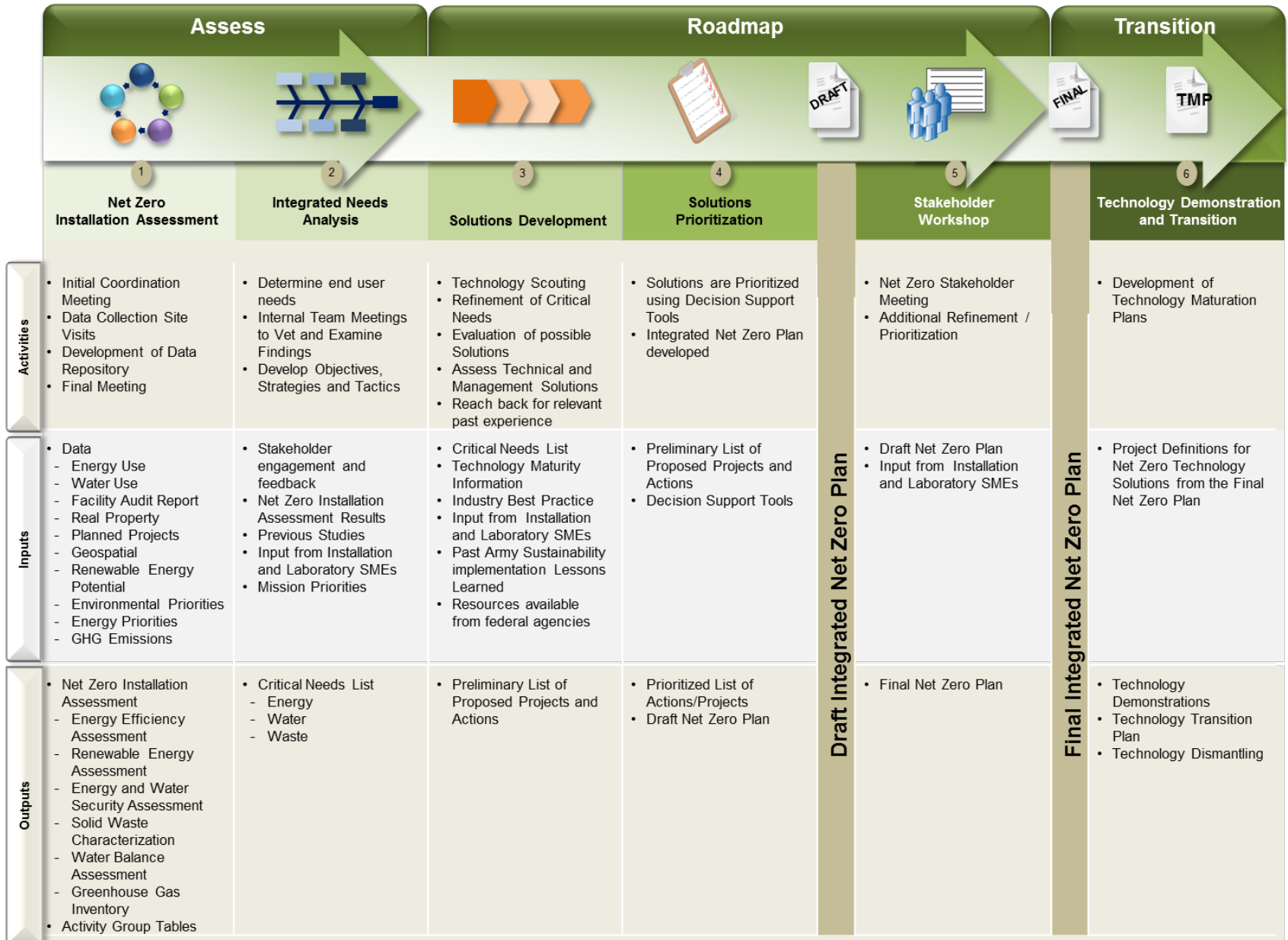
**FY12 Installation Management Resources = \$20.8B**

# Why Army NetZero?



- **A Net Zero ENERGY Installation** is an installation that produces as much energy on site as it uses, over the course of a year.
- **A Net Zero WATER Installation** limits the consumption of freshwater resources and returns water back to the same watershed so not to deplete the groundwater and surface water resources of that region in quantity or quality.
- **A Net Zero WASTE Installation** is an installation that reduces, reuses, and recovers waste streams, converting them to resource values with zero solid waste to landfill.
- **A Net ZERO INSTALLATION** applies an integrated approach to management of energy, water, and waste to capture and commercialize the resource value and/or enhance the ecological productivity of land, water, and air.

# Net Zero Planning Concept





# Net Zero Waste



## Waste Reduction

- Improved procurement (e.g., buy less, use “recyclable” content, reduce packaging material) and other P2 efforts

## Re-Purpose

- Furniture donations and re-use centers
- Match waste “products” with potential users (e.g., drywall as soil amendment)

## Recycling and Composting

- Installation recycling centers
- Food waste and organics composting

## Energy Recovery

- After meeting diversion goals
- Only where economically feasible

## Disposal

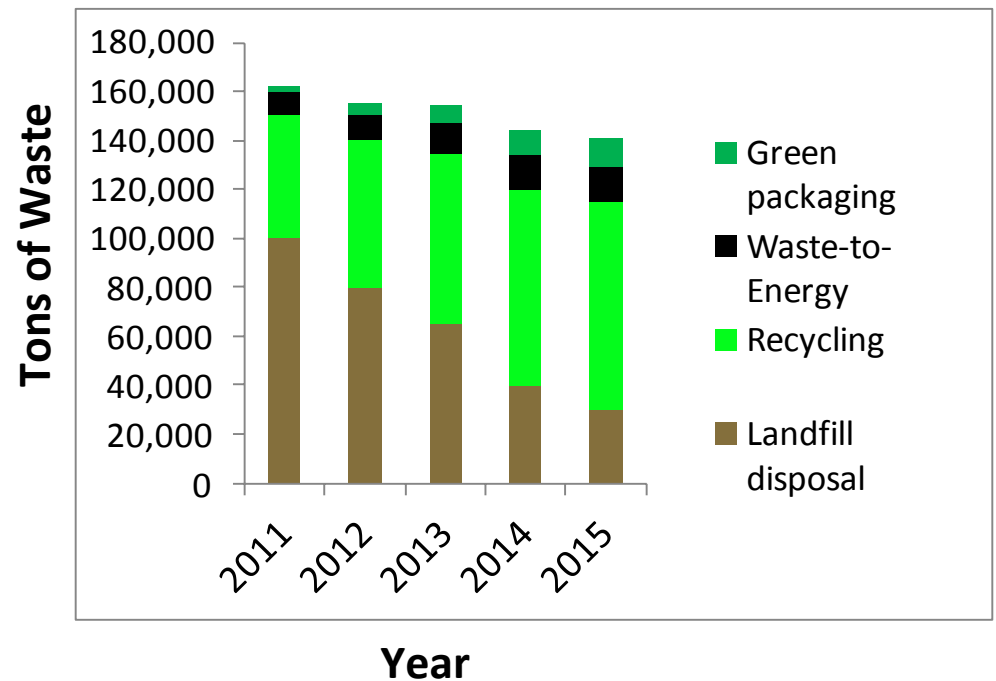
- Last resort after other economically feasible efforts are implemented

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

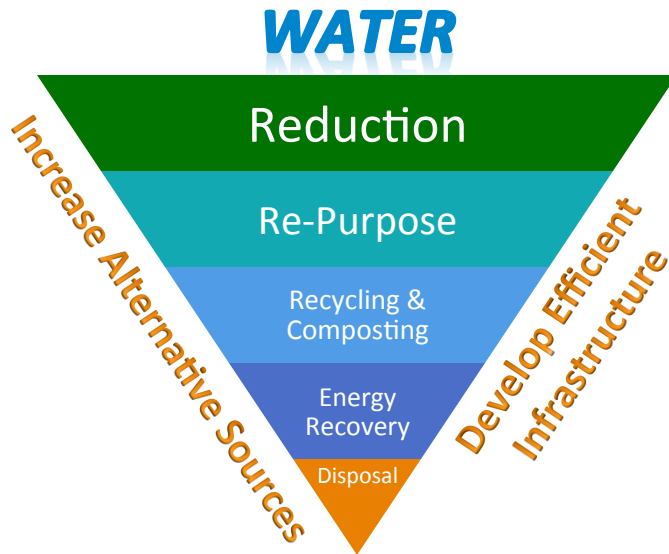
# Waste Roadmaps

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

Example Installation Waste Profile



# Net Zero Water

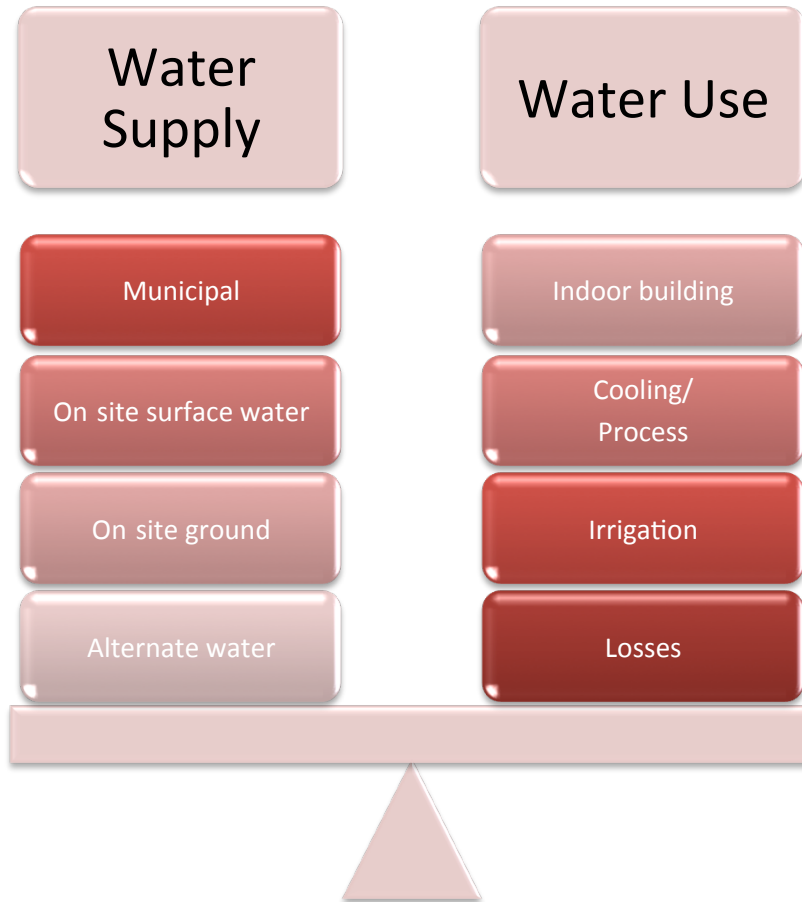


A Net Zero **WATER** Installation limits the consumption of freshwater resources and returns water back to the same watershed so as not to deplete the groundwater and surface water resources of that region in quantity and quality over the course of a year

## Goals:

- Contribute to water security
- Reduce freshwater demand through water efficiency and conservation
- Access/Develop alternate water sources to offset freshwater demand
- Develop water-efficient green infrastructure
- Implement low-impact development to manage storm water

# Water Balance

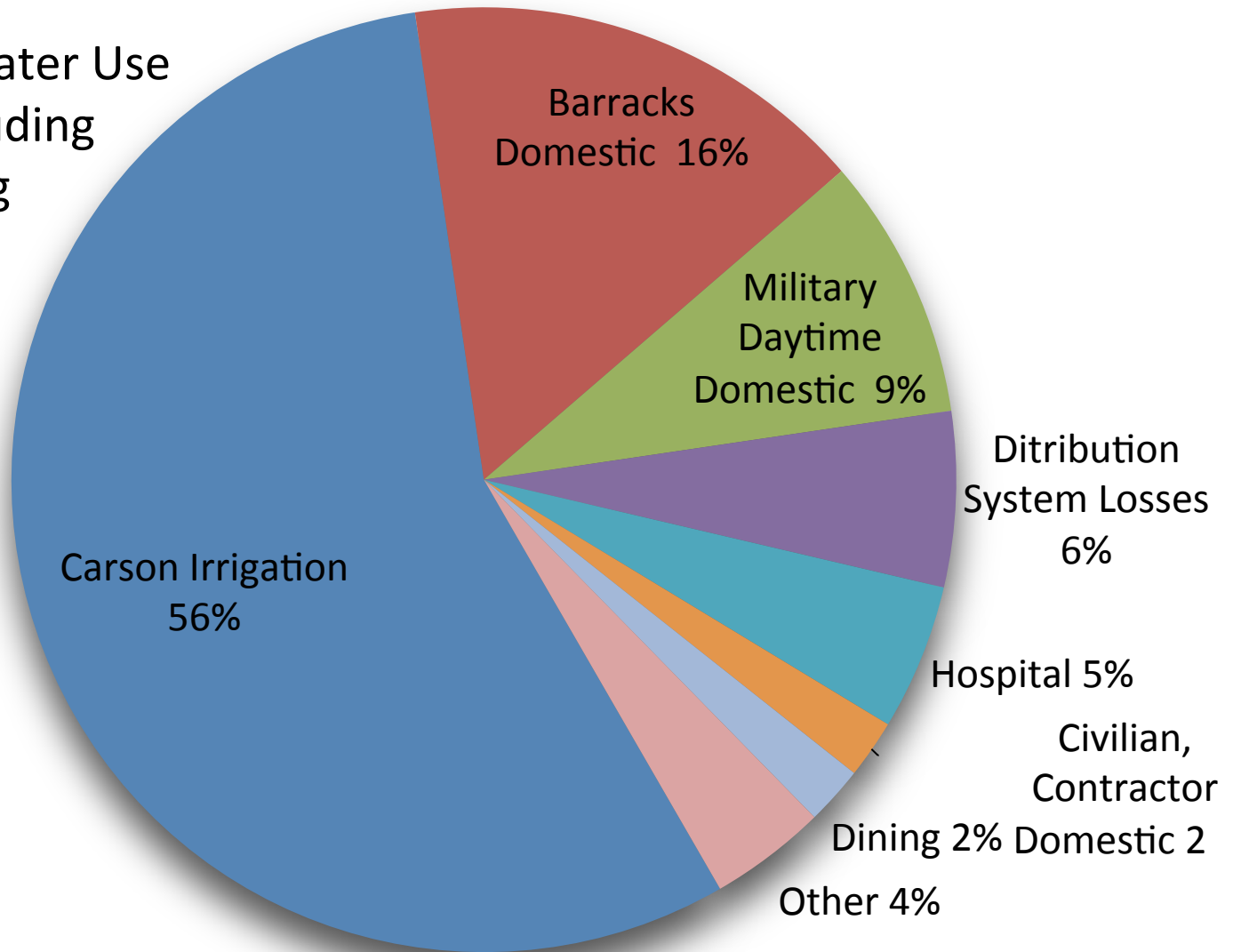


*Water Balance* = comparison of water supplied to water used.



# Water Balance Study

Fort Carson Water Use  
Breakout Excluding  
Family Housing



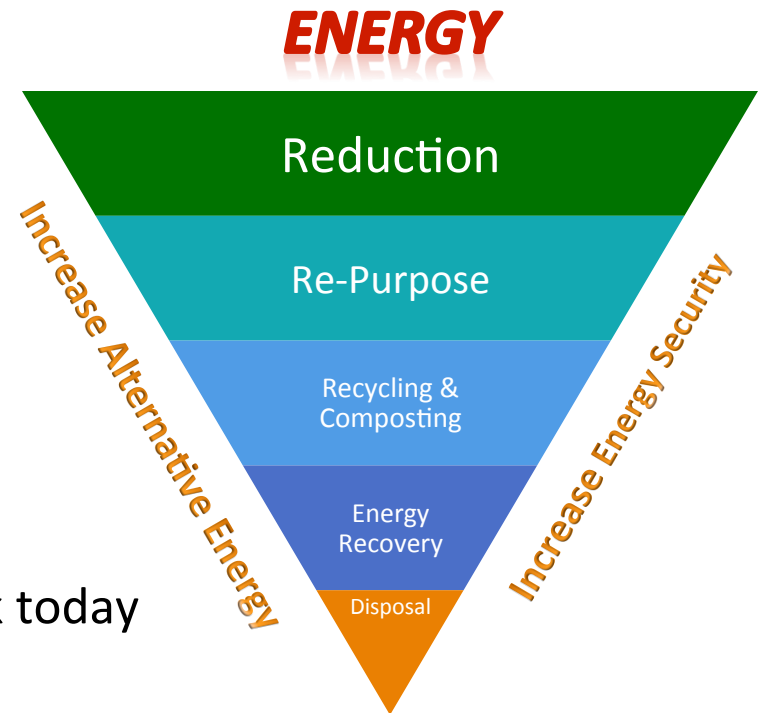
# Net Zero Energy

## A Net Zero ENERGY Installation

is an installation that produces as much energy on-site as it uses over the course of a year.

### Requires integrated approach:

- Dramatic demand-side energy use reduction
- We must build and retrofit our building stock today with life-cycle costs in mind.
- Right mix of energy generation technologies and strategies that contribute to energy security
- Clear and flexible implementation strategies based on potential technology innovations and mission changes



# Renewable Energy Assessments

## ■ Process

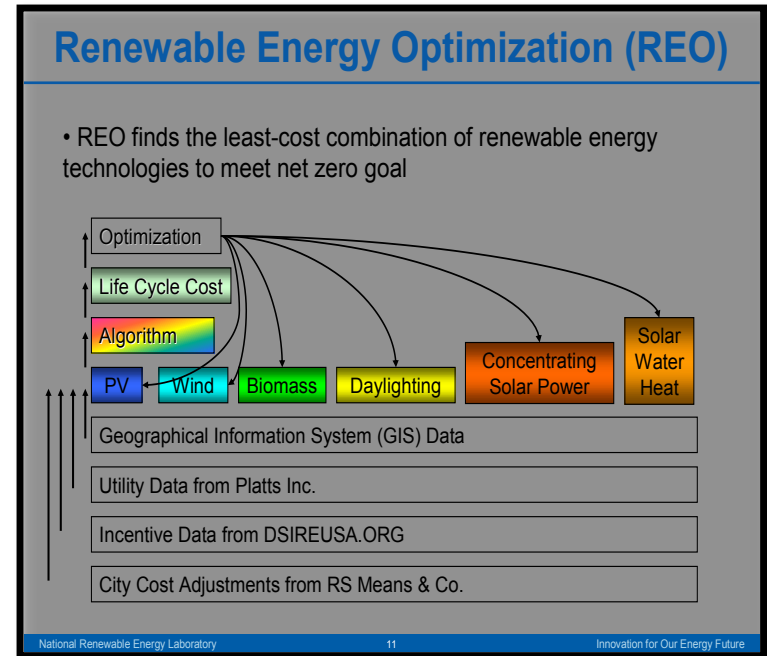
- Start with screening tools
- Conduct further analysis of promising technologies
- Make recommendations

## ■ Analysis tools

- GIS resource screening tools
- Renewable Energy Optimization, PVWatts, IMBY, RET Screen, Solar Analysis Model

## ■ Considerations

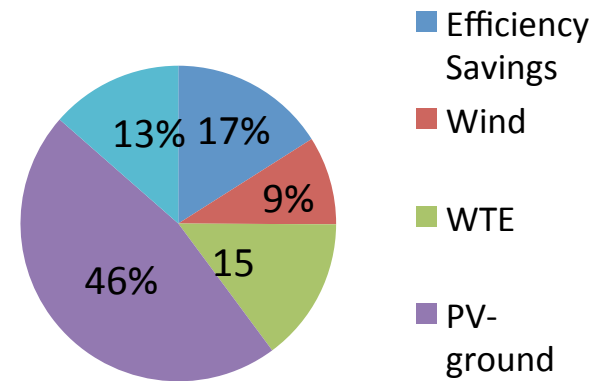
- Think outside the “standard tool box”



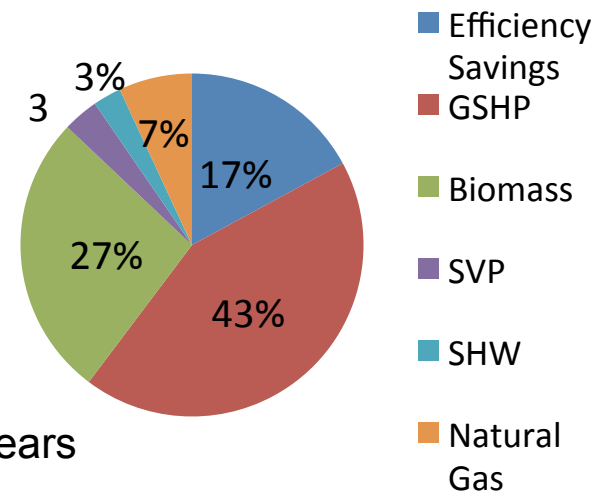
# NREL Recommendations

	Size	Energy Production (MMBtu)	LCOE (cents/kWh)
<b>Electrical:</b>	<b>100% Renewable</b>		
Wind	11.2 MW	84,082	5.80
WTE	5.6 MW	136,952	8.75
PV-Ground	83 MW	431,902	17.45
PV-Roof	24 MW	125,580	19.65
GSHP		-38,268	
<b>Thermal:</b>	<b>93% Renewable</b>		<b>(\$/MMBTU)</b>
GSHP	16,210 tons	410,451	\$2.81–\$4.64
SVP	106,798 ft <sup>2</sup>	31,964	\$3.30
Biomass	45 MMBtu/h	254,617	\$4.28
SHW	52,686 ft <sup>2</sup>	25,334	\$6.34

## Electric Energy



## Thermal Energy



\*Projected \$514M investment, \$322M premium over next 25 years



# LEED Facilities

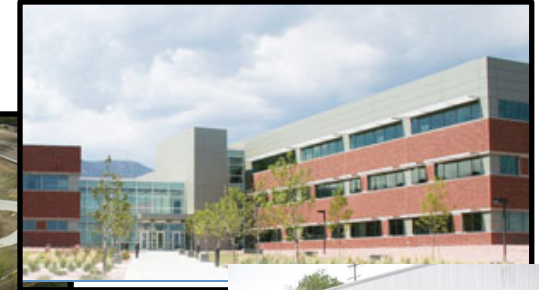


*William Reed Photo Art  
© Carson Roberts*

# The Installation Approach – Fort Carson

- **Net zero must address energy, water, and waste holistically**

- Energy and water
- Water and waste
- Waste and energy



- **Collaboration Across the Fence Line**

- Feds; DoE, EPA & GSA
- Local and regional partnerships to develop regional solutions (e.g., renewable energy, recycling, waste-to-energy)
- Public-private partnerships focused on implementing large-scale renewable energy projects



- **Nation Wide Roll Out**

# Achieving Success

- ✓ Leadership
- ✓ Passion
- ✓ Partnerships
- ✓ Funding
- ✓ Policies

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- Vince Guthrie, DPW Utility Program Manager  
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- Scott Clark, DPW Energy Program Coordinator  
(719) 526-1739, [scott.b.clark.ctr@mail.mil](mailto:scott.b.clark.ctr@mail.mil)
- FY11 Sustainability Report: <http://www.asaie.army.mil/Public/ES/netzero/>
- Army Energy Initiative Task Force: <http://armyeitf.com>





# FEDERAL UTILITY PARTNERSHIP WORKING GROUP SEMINAR

January 14-15, 2014

Golden, CO

## Case Study: Colorado Springs Utilities and Fort Carson

Hosted by:







# Who we are:



- Colorado Springs Utilities
- 213, 798 Service Points
- Over 500,000 customers
- 4 services: natural gas, energy, water, wastewater
- Municipally owned
- Serves 5 installations
- 60 miles S of Denver
- Fort Carson Army Post
- Over 30,000 residents
- Serve over 100,000/day
- Started 1942 in WWII
- Includes housing, SF, training, medical (EACH), heavy brigade, family, recreation, training lands
- 137,403 total acres

# Fort Carson and Colorado Springs

## Colorado



# Parallel Origins and Drivers for Fort Carson and CSU Partnerships

- 2000s Energy & Water Crises – Commodity Flux
- BRAC – Base Realignment and Closure - threat
- Encroachment – CO growth and sprawl -threat
- EPACT: improvements in performance & use
- Cost control + risk management; \$\$\$ & Permits
- Demographic/social trends, usage, competition
- Legal, Responsibility, Sustainability ethic
- SWOT analysis and community engagement

# Fort Carson's 2002 Sustainability Plan

- 25 year stretch goals: 2027 completion date
- Energy, Water, Waste, Air, Transportation, Built Environment, Training lands, Procurement
- Renewable energy, reduce water and energy consumption. Retrofits and new construction
- Create benchmarks; get help, get a plan, go!
- NREL, PNNL, USAMRA, USACE, CERL, SPiRiT
- ***Community partnership a primary strategy***



# Colorado Springs Utilities Goals

- CO Amendment 37; Renewable energy goal; 10%
- Drought, Climate, economy, demographics, peaks, rates
- Per capita use measurement, goals, strategies, programs
- ▲ business: combine Supply and Demand-side Education & Outreach; conservation incentives
- CWCB Water Conservation Plan - 2008-2012
- **Energy Vision: “By 2020, Colorado Springs Utilities will provide 20% of its total electric energy through renewable sources, reduce average customer use by 10% and maintain a 20% regional cost advantage.”**
- Launch Energy and Water Demand Side Management Programs; rebates, retrofits, audits

# CSU Water Conservation - Rebates

- CSU Offers commercial efficiency incentives
- Smart Controller Rebates: Up to \$400 per
- Irrigation Equipment: MP Nozzles, PRS Heads  
-new for 2013, allows FC to continue investing
- WaterSense/High Efficiency Toilets/Urinals –  
Up to \$125 per fixture, up to 300/yr (\$37,500)
- WaterSense products =>20% more efficient



Federal Utility Partnership Working Group  
January 14-15, 2014 Golden, CO



# CSU Energy DSM Rebates

- Indoor and Outdoor lighting
- Belts, Pulleys and Motors
- Free Retrofits- Light bulbs
- Renewable Energy & Solar thermal
- HVAC, PTACs, etc.
- Windows
- Peak Demand
- Occupancy Sensors



# Complementary || Developments

- EPA EnergyStar appliance improvements
- EPA WaterSense fixtures – 2006 – performance!
- USGBC's LEED for New Construction – 2000s
- Xeriscape, high efficiency irrigation, Recession
- HVAC, Lighting, Renewable Energy, 'Green stuff'
- GTA – Grow the Army – New Construction
- Pilot/test projects – Emulate & Use at War
- Additional Policy – EOs, IMCOM, GSA, etc.

# Complimentary Elements

- Fort Carson is CSU's largest customer
- Many of its Soldiers are also personal customers
- Fort Carson's willingness to lead and pilot new projects, technologies, partnerships, and behavior (social)
- Experience leads to other partnerships with customers, and new thinking; Solar Gardens, proof of concept.
- Community input, control, and benefits
- Helps CSU's Rates, Reliability and Relationships
- In 2011, Fort Carson was designated as a pilot Net Zero Installation for Energy, Water and Waste ("Triple Net 0") by the Assistant Secretary of the Army for Installations, Energy and Environment
- Pikes Peak Region 2030 Looking to our Future Sustainability Plan

# Projects – CSU Audits and Benchmarking

- **CSU provides professional energy audit services.** In 2010, for the base heating and cooling plant, the findings and recommendations included numerous items. As of Fall 2013, the following had been reported to be implemented:
  - Heating Plant
    - turn down heating temperature in vacant barracks
    - install low flow shower heads – completed by ESPC
    - turn down boiler supply temperature in summer
    - install smaller pump for boiler #3
  - Chiller Plant
    - Remove old orifice plates (pipe restriction)
    - Raise chilled water temperature
    - Replace cooling towers
    - Link the two control system computers with common software

# Projects – 2 MW Solar Array

- 2007/2008 – **12 Acre former construction landfill** – 3200 MWH - flat panel thin-film cadmium telluride. A **7 Partner Project** – Privately funded – RPS/REC credits – PPA -
- Through a power purchase agreement with Fort Carson, **Colorado Springs Utilities** builds and maintains the solar PV facility and provides the Fort with lower-cost electricity in return for leasing the site.
- Generates enough electricity annually to power **540 homes**, or 2.3% of the Fort's energy consumption.
- Project expected to **save Fort Carson \$500,000 in energy costs over the life of its 20-year contract with the utility.**





**Google Fort  
Carson Solar  
Array for details**

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# Additional Projects

- PV includes 235 kw carport, 482 kw tracking system.
- Installing 1.4 MW at consolidated PV site with another 300kw coming from a barracks project.
- Additional ECIP assessments and projects
- Implementing FEMP Best Practices:
- E.g.: Pre-Rinse Spray Valves, Smart meters.
- Existing Solar Thermal Wall and Hot Water



# Energy Savings Performance Contract Water *Phase 1*

- ❖ Audited 271 buildings
- ❖ Recommended fixture upgrades in 124-129 buildings
- ❖ Recommended 292 urinals
- ❖ Recommended 2,274 toilets
- ❖ Recommended 3,501 faucet aerators
- ❖ Recommended 1,713 shower heads
  
- ❖ Water Fixtures replaced
  - ❖ Urinals replaced: 24
  - ❖ Toilets replaced: 1,363 (3.5 to 1.28GPF)
  - ❖ Faucet 0.5gpm aerators: 656
  - ❖ Faucet 1.5gpm aerators: 630
  - ❖ Shower heads: 1,167

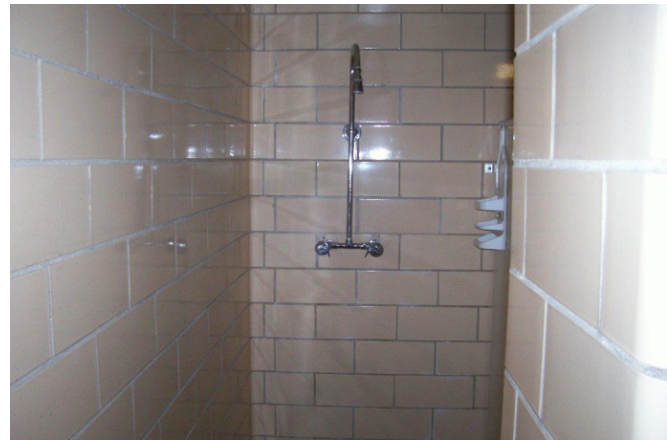
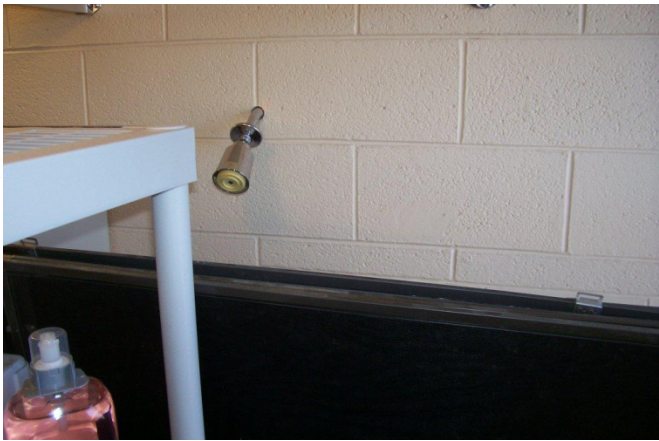
**\$37,500 Rebates with CSU**



❖ **Water Savings annually: 54,801kgal  
GUARANTEED**



Before





After



# Energy Savings Performance Contract

## *Phase 2 2014*

### **Water fixtures, urinals, toilets, aerators, shower heads:**

- **Water closets from 3.5 GPF to HET1.28 GPF 1454 each**
- **Urinals from 1.0/1.5 GPF to pint flush 121 each**
- **Showers from 2 /3/ GPM to 1.5 GPM 1309 each**
- **Replacing 2720 aerators on vanity faucets at .5 GPM and sink faucets at 1.5 GPM.**
- ❖ **Will qualify for another \$37,500 in rebates.**
- ❖ **Conducting a Leak Detection audit of 34 miles of water lines**
- ❖ **Further evaluation of - Direct Reusable Potable Water**

# Irrigation Rebate Participation

- \$53K Rebate for Smart Irrigation Controllers



**Housing retrofitted  
irrigation  
controllers for  
\$31K**



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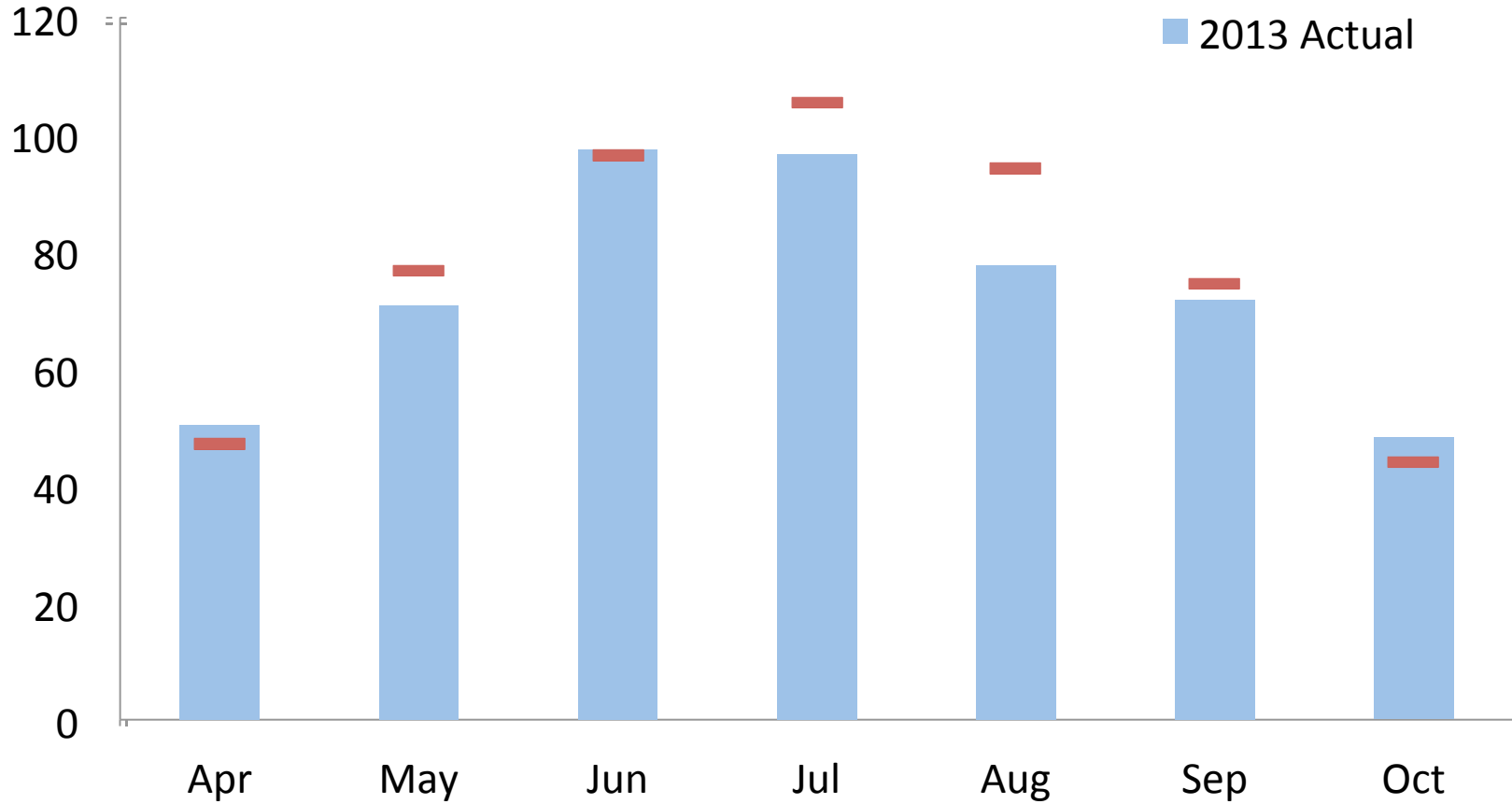


# Water Conservation -2013 Drought

- Ft Carson (as well as the other DoD Installations) did a remarkable job in conserving potable water. Ft Carson was able to use approx.
- **36% less water in 2013 compared to 2012 during the period from Apr - Oct.**
- The Installations' conservation efforts helped CSU achieve its 6BG water saving goals for 2013.

# Fort Carson Potable Water Use 30% Goal

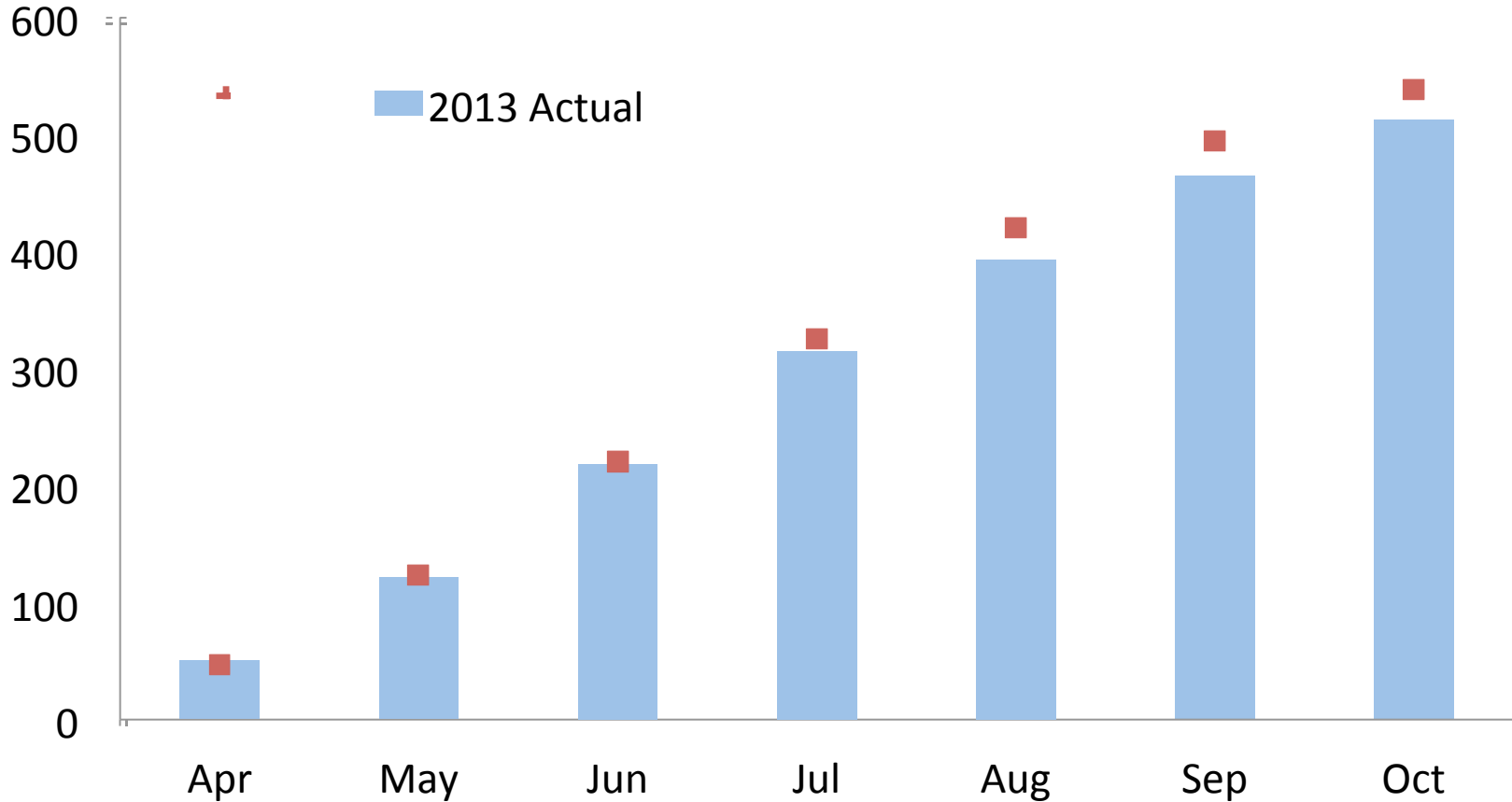
Million Gallons



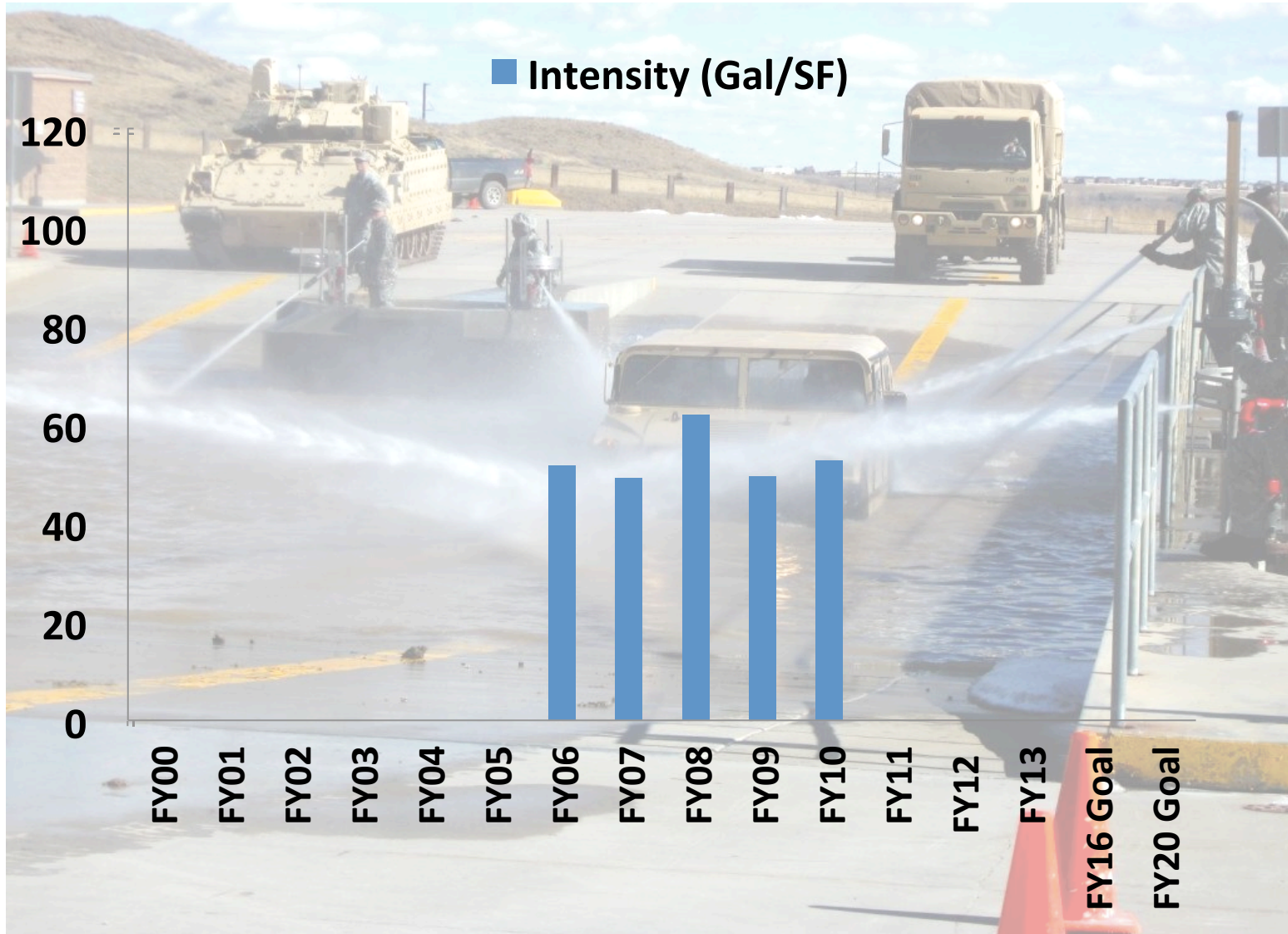
# Fort Carson Potable Water Use 30% Goal

Goal Exceeded: 33.4% Water Reduction from 1 Apr – 31 Oct 2013

Million Gallons

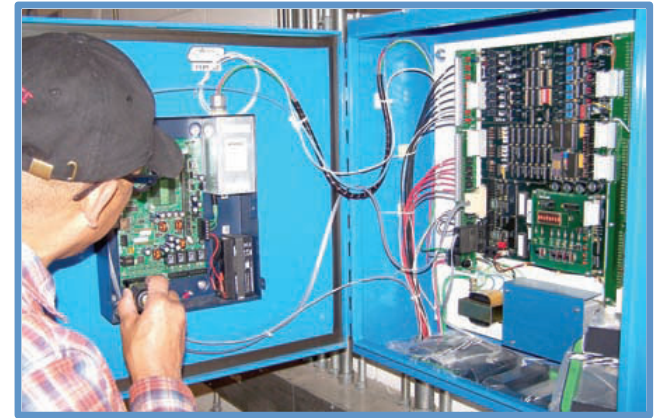


# Fort Carson Potable Water Use Intensity



# Energy Efficiency

- FY13 Electric
- Peak (including housing): 40 MW
- Electric (including housing): 206,599 MWH/YR
- Electric (without housing): 168,650 MWH/YR
  
- FY13 Renewables
- 2-year Wind Power Purchase: 80,000 MWH/YR
- On-Site Renewable Electric: 4,931 MWH/YR
- On-Site Renewable Thermal: 13,804 MBTU/YR
- Installation Renewable Electric: 41.1%
  
- FY13 Energy Efficiency
- Energy Intensity (not including housing): 104.9 KBTU/SF
- 16.3% reduction from FY03 baseline



ECMS Smart Meter

# Net Zero **Energy** – Ft Carson

- **Reduced energy intensity by 17%**

- Completing QUTM and ECIP projects: boiler replacements, lighting retrofits, control improvements
- ESPC Task Order 1 completed which included lighting, variable frequency drives, barrier improvements and water fixture replacements - \$37.5K-2013, 2014
- Focused effort to reduce energy using the Energy Management Control System to improve scheduling of facilities' thermostat settings



1.7 MW consolidated PV site

- **Demonstrations and Renewable Energy**

- SPIDERS microgrid and electric vehicle energy storage
- 1.7 MW of PV under construction as part of two MILCON projects
- Participating in several ESTCPs to include Biomaxx, First Fuel and CERL kitchen hood efforts



Bi-directional vehicle charging stations

# Projects – Woody Biomass Energy

- Program will begin in Jan 2014 and will end Dec 2014
- ( 12-month pilot program ).
- A few times a week Ft Carson will deliver waste wood product to Rocky Top, who in turn separates the wood, pulverizes it into usable pellets, and delivers to CSU's Drake Plant to be blended with coal.
- Ft Carson is providing 6 - 8% of the wood CSU will need to produce about 5 MW of energy.
- During this 12-month period CSU will evaluate if viable from: long term impact on boilers, operation of Drake, as well as economics.
- Ft Carson has agreed to purchase 912,500 kWh / month.



Woody  
Biomass at  
Martin Drake  
Power Plant



# Projects – Solar on Housing on FC

- Housing on FC is privatized, ran by Balfour Beatty Communities
- The solar panel provider will be Solar City and the total energy produced may be in the range of **10 MW - 15 MW ....**
- A respectable volume of energy and of interest to CSU for energy planning purposes.



# 2013/2014 Projects - Windpower

- CSU's wind purchase program Jan 2013 - Dec 2014
- Contract between Xcel Energy and CSU to purchase 108,000 MWH annually of wind power;
- During this 2 year period CSU is offering wind to its customers and Ft Carson is buying 6,666 MWH's/month (approx 80,000 MWH annually)
- By far CSU's largest off taker of wind. CSU does not know at this time if additional wind from Xcel will be contracted beyond 2014.

# Projects – Dual Fuel Generation

- Ft Carson is planning to build a 3 MW dual fuel generation site near their airport.
- Initially the primary source of fuel will be natural gas; Designed to also use biogas or a synthetic gas. Fort Carson is uncertain where they might get biogas or synthetic gas for this plant.
- Discussions about the biogas CSU has at Clear Springs Ranch facility; however, in that process we have learned that CSU has some ideas for that biogas for its own purposes in the future and until those plans are finalized, it is unlikely CSU can commit to supplying Ft Carson with said biogas.

# Potential Additional Projects

- WaterSense MF New Home Rebates - \$275/Home to Balfour Beatty – 20% > than code
- Requires WaterSense Fixtures, E\* appliance, and efficient hot water delivery
- EnergyStar New Homes – Up to \$800/Home – depends upon HERS score.
- Comfort, risk aversion
- High performance





# Thank You



## Questions:

**Mark Mahoney, Army REEO-W**

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**Frank Kinder, CSU**

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