



Atlantic Council



How the U.S. Army is Addressing the Energy-Water Nexus

Keynote Presentation

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Installations, Energy & Environment

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



U.S. ARMY

FY12 ARMY UNIVERSE

(Data collected 30 Sep 11)



Land Acreage

- United States 14,024,798
- Europe 139,577
- Asia 22,866
- Other Overseas 2,673

Roads (paved and unpaved)

- 70,324 Miles

Paved Area (excluding roads)

- 300,112 Million square yards

Railroads

- 3,936 Miles

Family Housing Units

- Owned 15,281
- Leased 7,945
- Privatized 81,837

Barracks

Adequate Spaces

- Permanent Party 136K
- Training 51K
- ORTC 103K

Plant Replacement Value

- \$329B

Army Installations

- IMCOM 69
- Army Reserve 3
- National Guard 47
- AMC 28
- SMDC 1
- MEDCOM 2
- DLA 5

TOTAL 155

Army End-Strength

- Active 565,500
- USAR 204,800
- ARNG 361,600
- Civilians 278,600
- Retired 878,400

Airfields

- Fixed Wing 179
- Helipad 902

Buildings

(Million square feet)

- United States 841.2
- Europe 116.3
- Asia 43.7
- Other 3.4

Utilities

(Electric, Gas, Water, Sewer)

- 71,012 Miles

Army Demographics
 59.6% total married
 (8.8% dual military married)
 6.7% single parents
 899,465 family members

Environmental Clean-up Remaining

(Installation Restoration Program & Military Munitions Response Program)

- Active Sites 2,075
- BRAC Sites 397
- Formerly Used Defense Sites 1,944

Installations, Energy & Environment)

FY11 Installation Management Resources = \$20.8B



Army Energy Consumption & Investment



United States



1%

Federal Government



80%

DoD

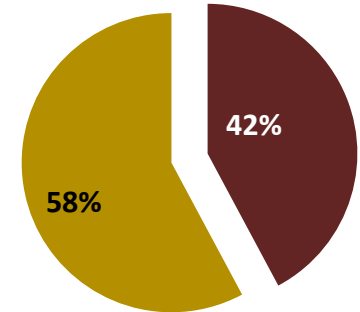
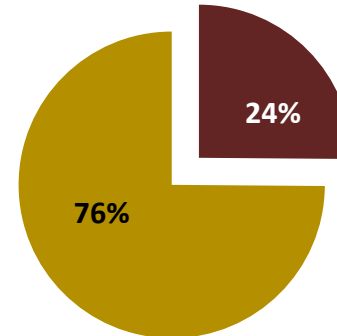
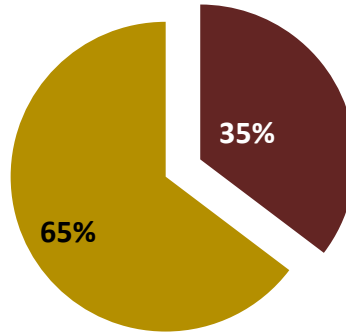


23%

U.S. Army



- Facilities
- Vehicles & Equipment
(Tactical & Non-tactical)



FY11 Stats

- \$3.7B Liquid Fuel Costs
- \$1.3B Facility Energy Costs
- +1B Increase in Fuel Costs over FY10



Net Zero

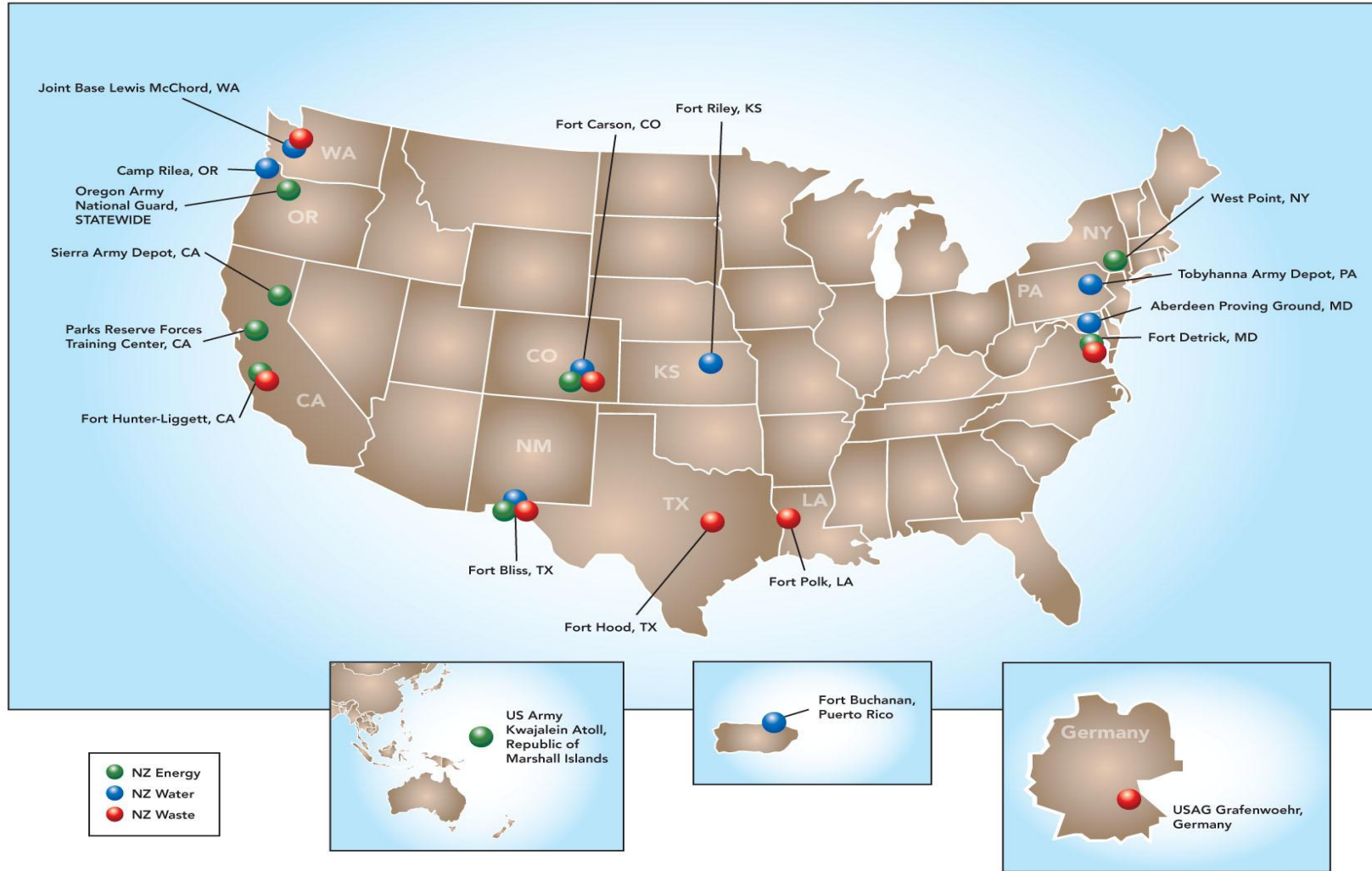


- **A Net Zero ENERGY Installation** is an installation that produces as much energy on site as it uses, over the course of a year.
- **A Net Zero WATER Installation** limits the consumption of freshwater resources and returns water back to the same watershed so not to deplete the groundwater and surface 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 Installations



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



U.S. ARMY

Current Mandates



| Federal Mandate | Focus Area | Performance Target |
|--------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Energy Policy Act of 2005 | Electricity use for federal government from renewable sources | <ul style="list-style-type: none"> At least 3% of total electricity consumption (FY07-09), 5% (FY10-12), 7.5% (FY13 +) |
| Executive Order 13423 | Energy use in Federal buildings | <ul style="list-style-type: none"> Reduce 3% per year to total by 30% by FY2015 (FY2003 baseline) |
| | Total consumption from renewable sources | <ul style="list-style-type: none"> At least 50% of required annual renewable energy consumed from “new” renewable sources |
| | Fleet vehicle alternative fuel use | <ul style="list-style-type: none"> Increase by 10% annually to reach 100% (FY2005 baseline) |
| Energy Independence & Security Act of 2007 | Total consumption from renewable sources | <ul style="list-style-type: none"> 25% by FY2025 -”Sense of Congress” |
| | Hot water in new / renovated federal buildings from solar power | <ul style="list-style-type: none"> 30% by FY2015 if life-cycle cost-effective |
| | Fossil fuel use in new / renovated Federal buildings | <ul style="list-style-type: none"> Reduce 55% by FY2010; 100% by FY2030 |
| Executive Order 13514 | GHG emission reduction | <ul style="list-style-type: none"> DoD Goal: reduce Scope 1 & 2 GHGs by 34% by FY2020 DoD Goal: reduce Scope 3 GHGs by 13.5% by FY2020 |
| | Net zero buildings | <ul style="list-style-type: none"> All new buildings that enter design in FY2020 & after achieve net zero energy by FY2030 |
| | Water consumption | <ul style="list-style-type: none"> Reduce consumption by 2% annually for 26% total by FY2020 (FY2007 baseline) |
| | Waste minimization | <ul style="list-style-type: none"> Divert at least 50% of solid waste & 50% of C&D waste by FY2015 |
| National Defense Authorization Act, 2010 | Renewable fuels use | <ul style="list-style-type: none"> Directs the Secretary of Defense to consider renewable fuels in aviation, maritime, and ground transportation fleets. |
| | Facility renewable energy use | <ul style="list-style-type: none"> Produce or procure 25 % of the total quantity of facility energy needs, including thermal energy, from renewable sources starting in FY2025 |



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.

Goals:

- Contribute to the Army Campaign Plan's objective of energy security for the Army
- Address energy efficiency & conservation first
- Preference for use of renewable energy for on-site power; enables operation if grid goes down
- Must address redundant energy supply sources
 - Can the installation function for long periods of time during supply disruptions affecting the electric grid, natural gas pipeline, propane & fuel oil deliveries, etc.
- Applies to both electrical & thermal energy
- Behavioral change are necessary to change culture
- Must be fiscally responsible

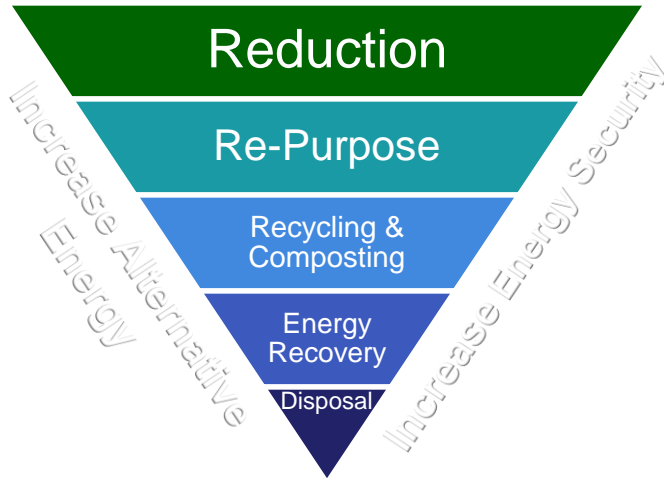




Net Zero Energy



ENERGY



We must build & retrofit our building stock today with life-cycle costs in mind

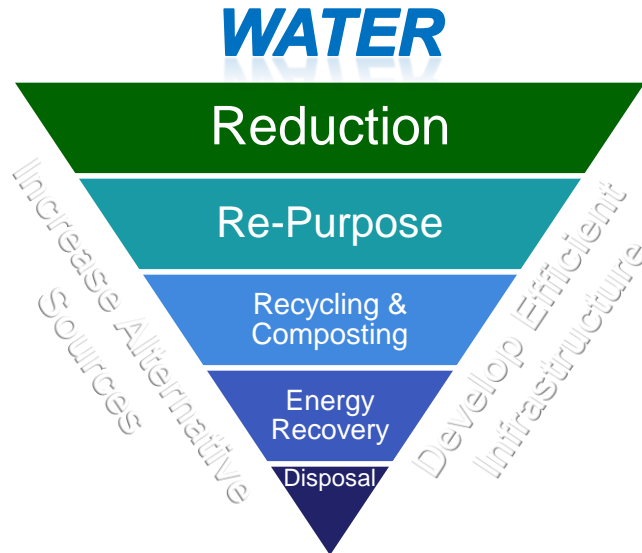
Requires holistic approach:

- Dramatic demand-side energy use reduction
- Right mix of energy generation technologies & strategies that contribute to energy security
- Areas/building clusters served by small Central Utility Plants
- Clear & flexible implementation strategies based on potential technology innovations & mission changes

| Elements of Net Zero Energy |
|------------------------------------------------------|
| Army Campaign Plan & energy security |
| Integrate energy considerations into Master Planning |
| Increase energy efficiency in new construction |
| Reduce energy consumption in existing facilities |
| Reduce dependence on fossil fuels |
| Improve energy security |



Net Zero Water



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

Goals:

- Contribute to the Army Campaign Plan's water security Major Objective
- Reduce freshwater demand through water efficiency & conservation
- Access/develop alternate water sources to offset freshwater demand
- Develop water-efficient green infrastructure
- Implement low-impact development to manage storm water



Elements of Net Zero Water



| | |
|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Army Campaign Plan & water security</i> | <ul style="list-style-type: none">▪ Support the water security Major Objective |
| <i>Water conservation and efficiencies</i> | <ul style="list-style-type: none">▪ Identify & eliminate water inefficiencies (e.g., distribution system losses, evaporation losses)▪ Implement low-impact development strategies that retain storm water runoff▪ Implement a water conservation awareness campaign to change employee behavior |
| <i>Water reuse</i> | <ul style="list-style-type: none">▪ Implement water reuse strategies▪ Include gray-water systems in new building designs where cost effective |
| <i>Water security</i> | <ul style="list-style-type: none">▪ Improve the security & reliability of our water systems to provide dependable water service to critical infrastructure during external service disruptions▪ If served by public water systems, establish alternate water supplies |



Net Zero Waste



A Net Zero **WASTE** Installation

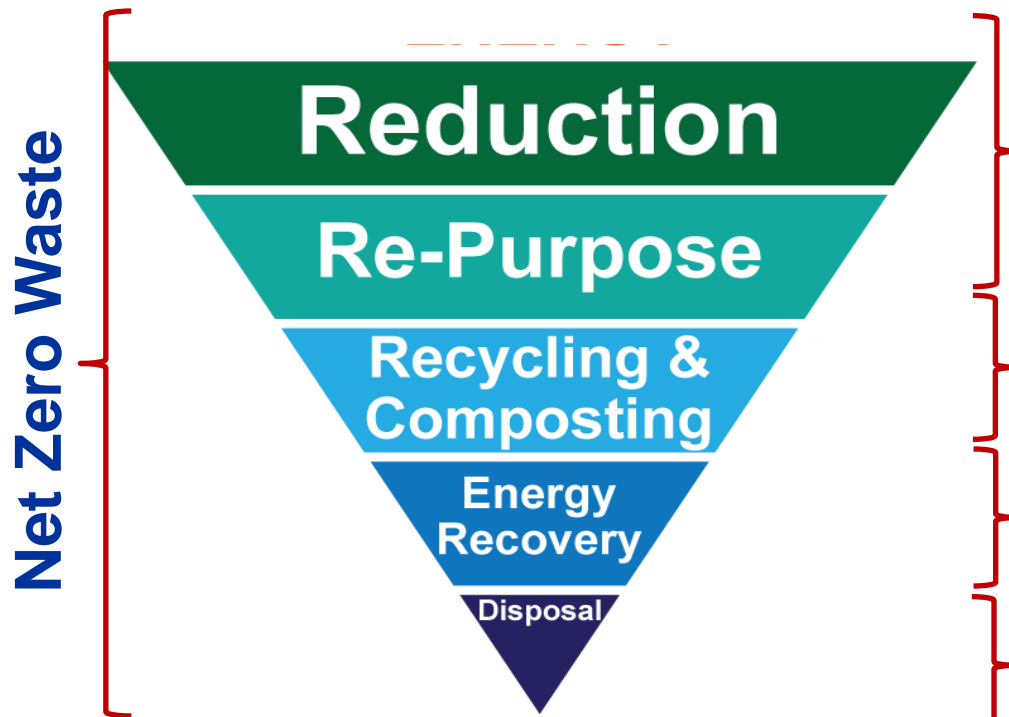
reduces, reuses, & recovers waste streams, converting them to resource values with zero solid waste to landfill over the course of a year

Goals:

- Eliminate unnecessary purchase of materials
- Minimize amount waste generated wherever feasible
- Expand efforts to re-purpose & recycle/divert used materials
- Use Waste-to-Energy technologies for waste that cannot be avoided, re-purposed, recycled, or composted
- Eliminate landfill disposal to the maximum extent feasible



Net Zero Waste



Waste Reduction

- Improved procurement (e.g., buy less, 'recyclable' content, reduce packaging material) & other P2efforts

Re-Purpose

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

Recycling & Composting

- Installation recycling centers
- Food waste & organics composting

Energy Recovery

- After meeting diversion goals
- Only where economically feasible

Disposal

- Last resort after other economically feasible efforts are implemented

Goal: zero solid waste disposal in landfills by FY2020



How



Net Zero – Audits & Roadmaps



■ Establishing the baseline

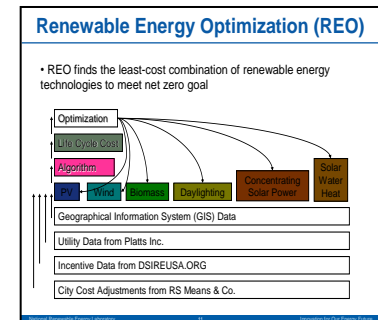
- Completed energy audits at Net Zero Energy pilots
- Conducting water balance assessments at Net Zero Water pilots
- Conducting material flow analysis at Net Zero Waste pilots

■ Assessing the potential

- Conducting renewable energy audits at Net Zero Energy pilots
- Identifying water reuse opportunities at Net Zero Water pilots
- Identifying additional re-use & diversion opportunities at Net Zero Waste pilots

■ Planning the future

- Completing Net Zero 2020 roadmaps in 2012 for Energy, Water & Waste pilots with project lists & actions to implement over the next 8 years



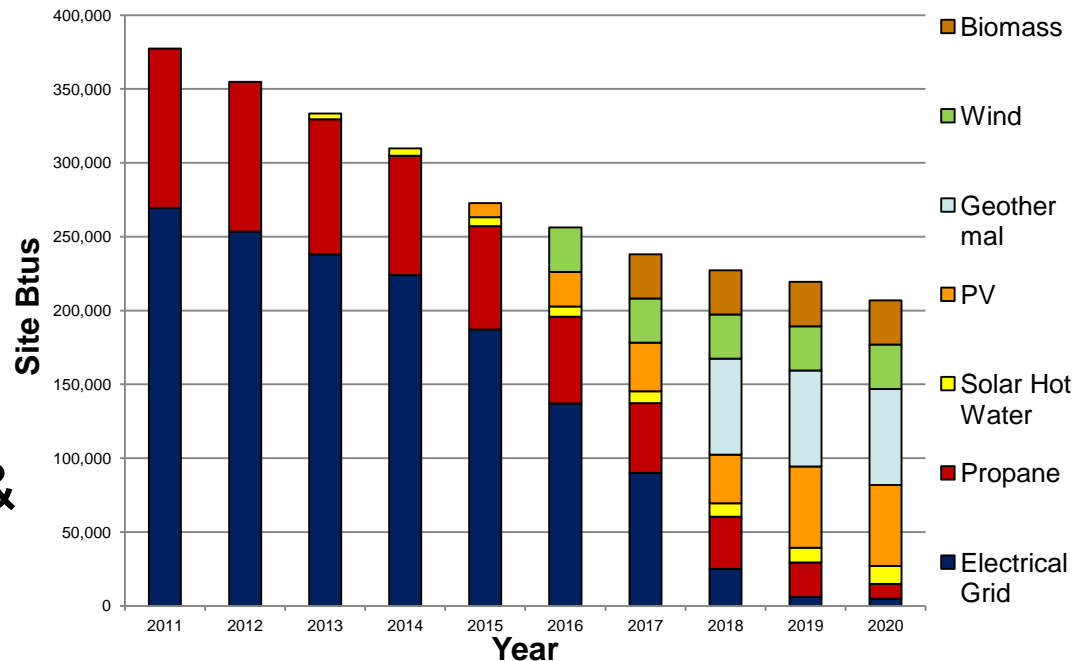


Energy Roadmaps



- Energy baseline
- Energy efficiency assessments
- Renewable energy assessments
- Energy security Assessments
- Energy project list & implementation of recommendations

Example Installation Energy Profile





Renewable Energy Assessments



■ Process

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

■ Analysis tools

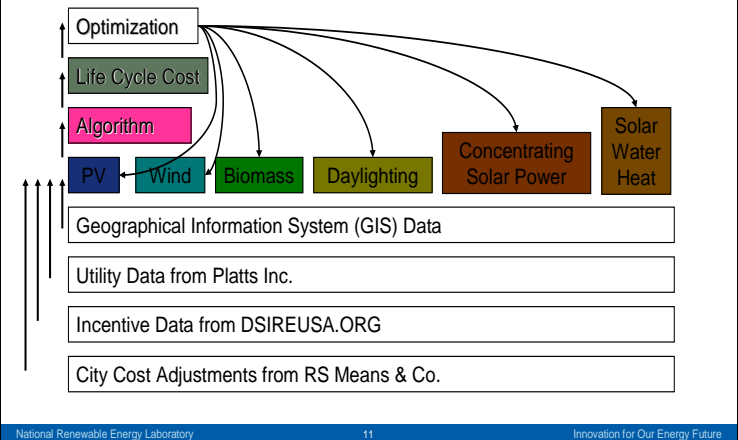
- GIS resource screening tools
- Renewable Energy Optimization (REO), PV Watts, IMBY, RET Screen, Solar Analysis Model (SAM), etc.

■ Considerations

- Think outside the “standard tool” box
→ fuel cells, microturbines, solar pools, etc.

Renewable Energy Optimization (REO)

- REO finds the least-cost combination of renewable energy technologies to meet net zero goal





Water Roadmaps



▪ Water Balance

- Identify largest end-users
- Set priorities

▪ Water Efficiency Opportunities

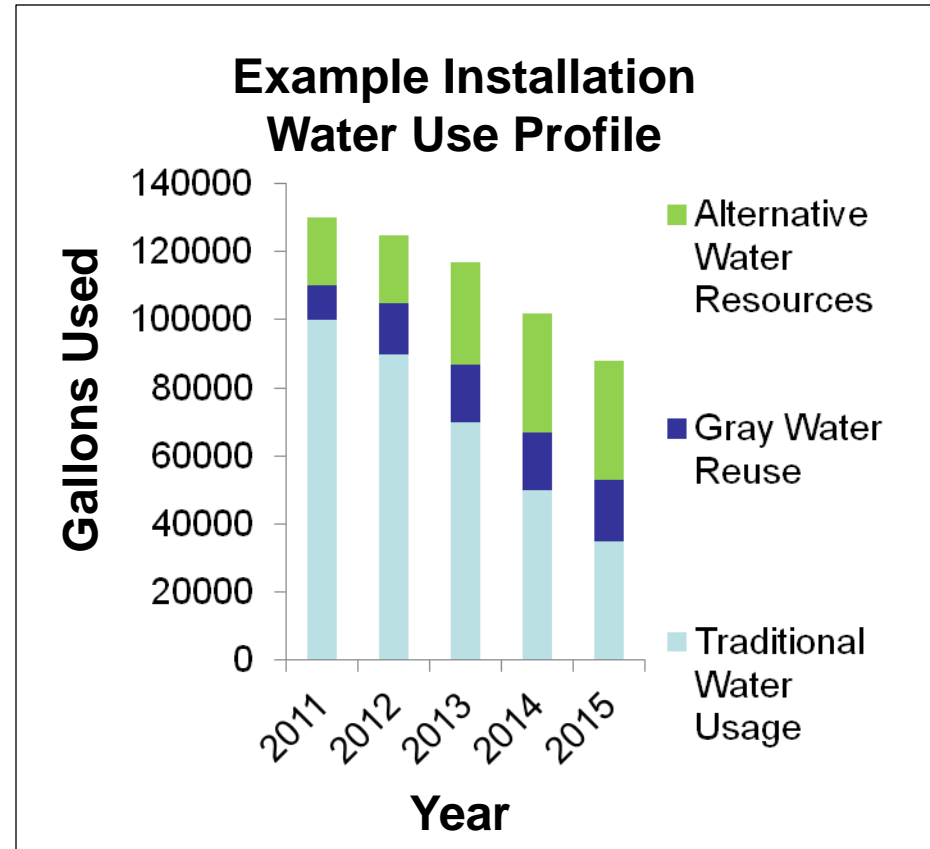
- Perform LCC analysis on measures
- Rank order projects
- Include technology & behavioral changes needed

▪ Roadmap Workshop

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

▪ Roadmap & Master Planning

- Finalize strategy
- Incorporate into master planning

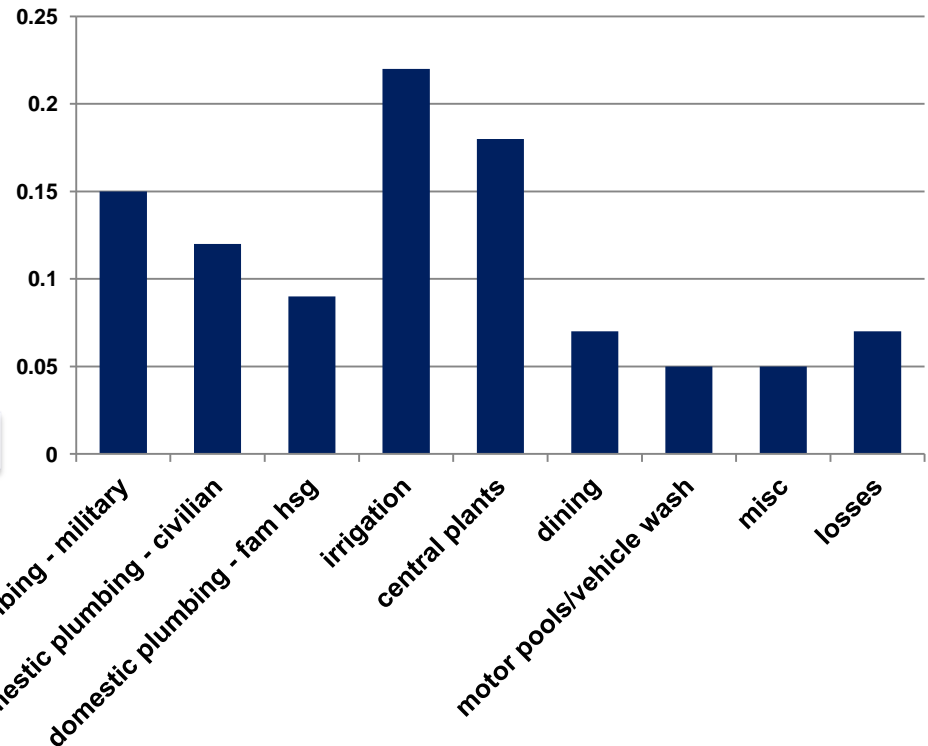
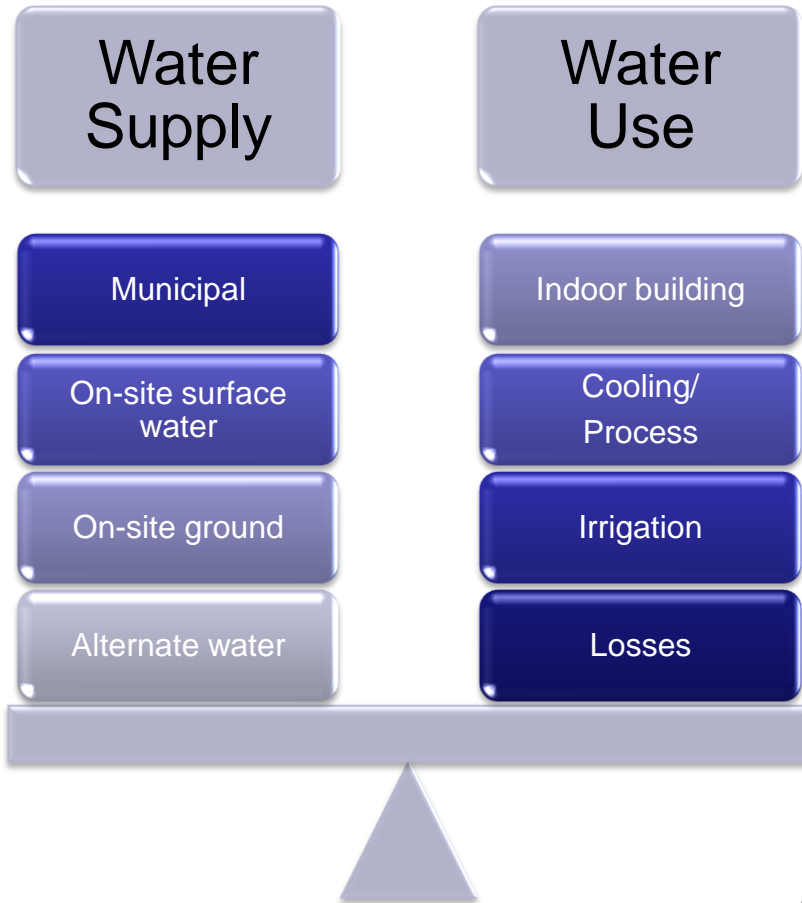




Net Zero – Water Balance



Water Balance = comparison of water supplied to water used.



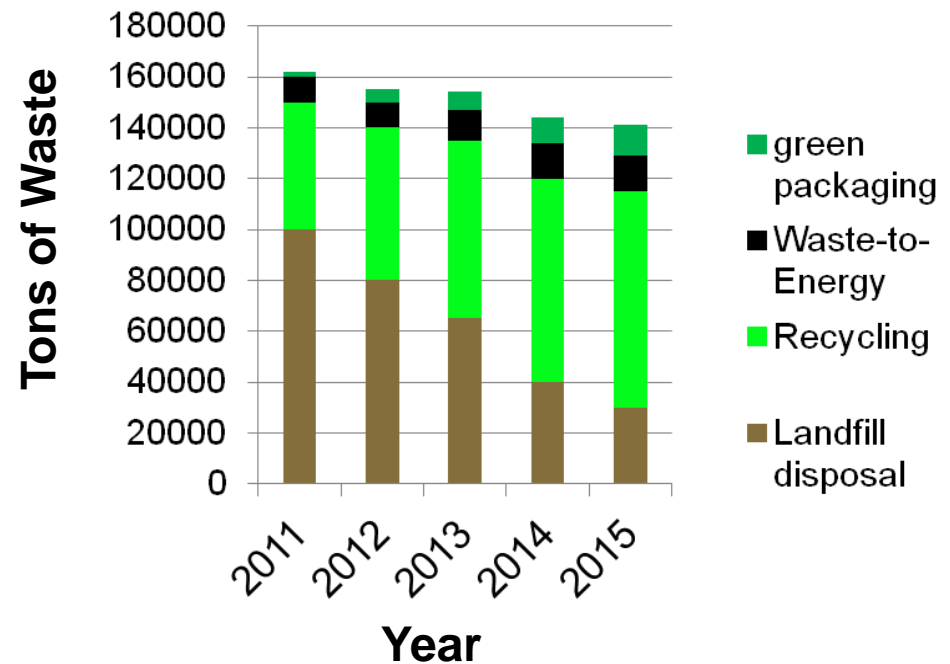


Waste Roadmaps



- Material flow analysis
- Improved procurement practices
- Re-purpose / re-use strategy
- Recycling & composting strategy
- Potentially viable technologies
 - Waste-to-energy, biomass, food waste digesters, etc.

Example Installation Waste Produced Profile





Material Flow Analysis

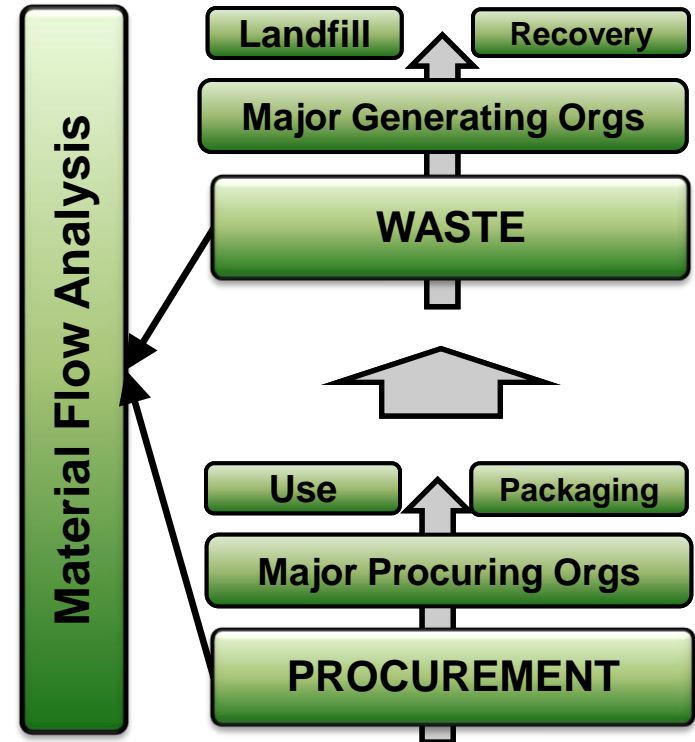


■ Objective:

- Analyze waste streams (outputs) and procurement (inputs) to support NZ Waste strategies

■ Approach:

- Use readily available data
- Organize analysis by activity type
 - Dining facilities / food sales
 - Construction
 - Vehicle maintenance
- Identify priority waste streams for reduction / elimination





Systems-of-Systems Approach



- **Interconnections**
 - Energy & Water
 - Water & Waste
 - Waste & Energy
- **Net Zero must be addressed holistically across energy, water & waste**



Net Zero – Army Collaboration



- **Monthly Collaboration Calls**
 - One for each area (energy, water, waste)
 - Pilot installations report progress & new initiatives

- **Website**

- Public page
- Army-only pages
- Pilot Installation pages

- **Periodic webinars**

- **Net Zero workshops & training**



For more information:

<https://eko.usace.army.mil/public/fa/netzero/>

<http://www.asaie.army.mil/Public/IE/>



Net Zero – External Collaboration



- **Federal agencies:**

- DOE: FEMP, NREL, PNNL on Net Zero energy & water
- EPA: technologies to support Net Zero Water
- GSA: HPSBs, Net Zero energy & water for multiple building complex

- **Local & Regional partnerships**

- Pilot installations are working with local communities to develop local & regional solutions (e.g., renewable energy, recycling, WTE)

- **Public-private partnerships**

- Targeted to implement large-scale renewable energy projects



Leveraging Private Investments



▪ Energy Savings Performance Contracts (ESPC)

- Utilize private capital to make infrastructure improvements
- Payment is derived from the savings generated by the improvements; savings are verified through Measurement & Verification

▪ Utility Energy Service Contracts (UESC)

- Procurement method using utility expertise & capital to meet Federal conservation mandates
- Utility's costs repaid directly from installation's avoided costs resulting from project implementation

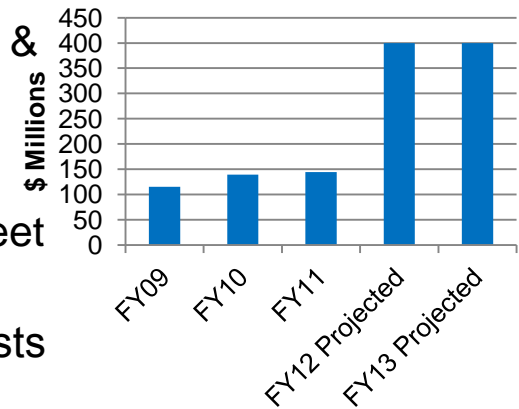
▪ Enhanced Use Lease (EUL)

- Funding method for construction on installations by allowing a private developer to lease underutilized property
- Payment usually in the form of power back to the installation

▪ Power Purchase Agreement (PPA)

- Allow federal agencies to fund on-site renewable energy projects with no upfront capital costs incurred

Value of ESPCs & UESCs Awarded



High Efficient Boilers
Picatinny Arsenal, NJ



Operations



Army Power & Energy



Basing

Installation

Contingency



Soldier



Vehicles

Tactical

Non Tactical

Air

Land



**OPERATIONAL ENERGY
NET ZERO STRATEGY**

“Grand Challenges”

- Give soldiers and leaders capability to manage energy status, resources, performance
- Significantly reduce energy footprint
- Provide flexibility and resiliency by developing alternatives and adaptable capabilities

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



Basing Power



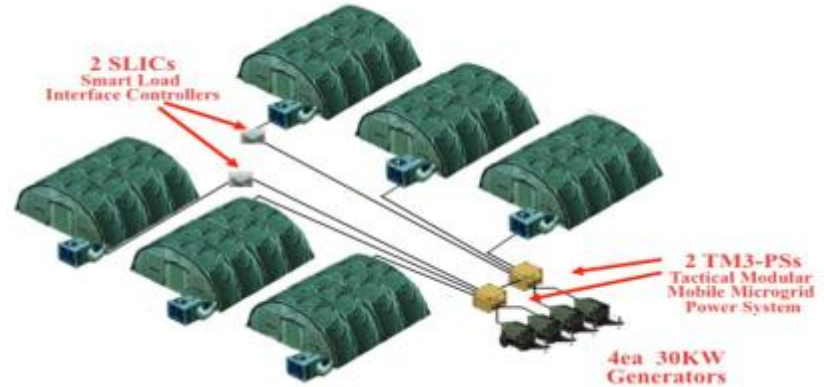
Spot generation on contingency bases resulted in wasted power generation & fuel

Solution – Replace With Minigrids

- Save fuel
- Less maintenance
- Fewer outages
- Off-the-shelf, readily available technology

Result

- Saving 50 million gallons of fuel annually
- Equivalent to removing 20,000 HEMTT loads or 55 trucks per day
- Removed more than 1,900 spot generators
- Reduced maintenance costs
- Short payback
- Soldiers now available to accomplish alternate missions





Basing Power



Village Stability Platform (VSP) Case

- Rapid Equipping Force (REF) provided an assessment of a VSP in Afghanistan & implemented fixes based on that assessment
- Austere environments that are difficult to resupply with high threat to ground resupply
- Resupply largely from air drops
- Identified possible efficiencies & technology

Results

- Significant reduction in fuel usage (33% reduction)
- Reduced resupply demand
- Improved reliability of supply
- Improved efficiency of generators
- Reduced O&M on wet stacked generators
- Increased safety and reliability, due to electric system fixes

| | Pre E2E Feb 12 | Post E2E April 12 |
|------------------|------------------------|----------------------|
| Generators | 5 (240kW) | 3 (165 kW) |
| Power Usage | 121 kW | 107 kW |
| Fuel Consumption | 360 gal/day | 240 gal/day |
| Fuel Savings | 120 gal/day | |
| CDS Reduction | 16 CDS bundles / month | |



Balanced generators with loads – two generators taken offline



Hybrid Solutions to Increase operational reliability & reduce fuel consumption



Resupply via air drops

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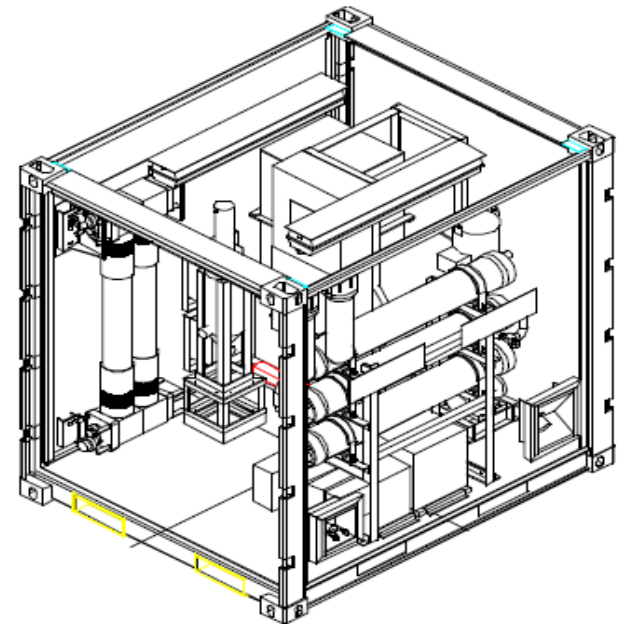
Basing Power



Goal: reduce fresh water demand

Force Provider Shower Water Reuse System (SWRS)

- Can process up to 12,000 gallons per day, putting up to 9,000 gallons back into the water system for shower, laundry, & latrine use
- Provides a 75% reduction in water resupply demand





Basing Power



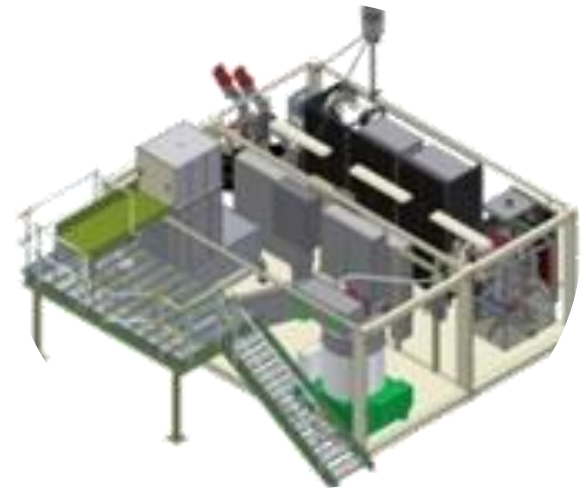
Goal: reduce waste generation & improve disposal practices

- **Evaluating materials & packaging to reduce volume of waste generated**

- Compostable or combustible MRE packaging
- Water purification vs. bottled water

- **Evaluating deployable waste-to-energy systems to:**

- Reduce land-based disposal
- Provide alternative energy source





ARMY STRONG