Targeting Net Zero DoD Project Review FUPWG

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NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

Summary

- **NREL has been supporting DoD Net Zero Energy efforts since 2009**
  - DoD is most interested in cost savings, energy security, and goals/mandates
- **Installations are like small cities with huge potential for change**
  - 2 B sq. ft., $ 4 B facility energy, 29 M acres
- **Net zero energy installation -> produce as much energy as you consume**
  - Systems thinking for energy projects
- **Good progress to date but many more projects are needed to reach net zero**
  - Miramar and Fort Hunter Liggett are leading the way

Net Zero Process

Assessment

Baseline

- Current energy consumption

Energy Efficiency

- Retrofit improvement potential
- New construction design optimization

Renewable Energy

- Deployment of renewable energy

Electrical Systems

- Interconnection and microgrid

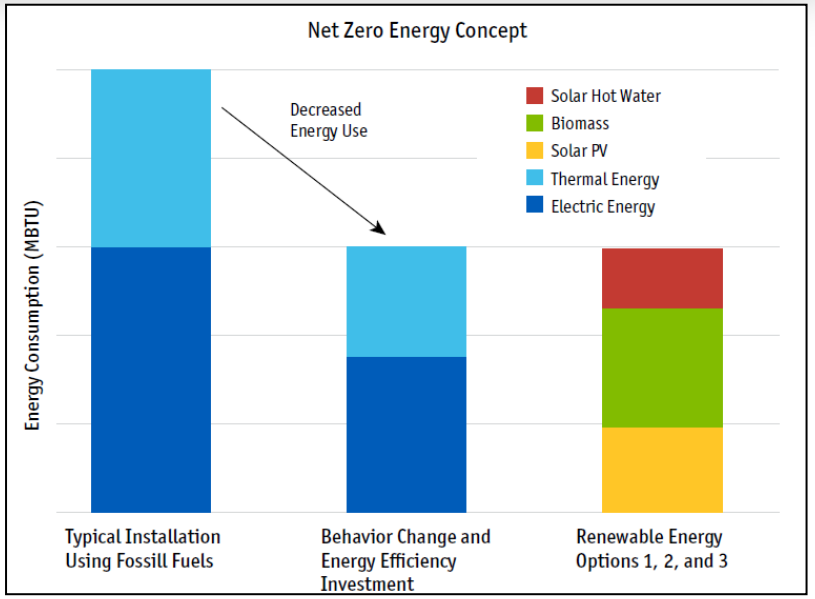
Implementation

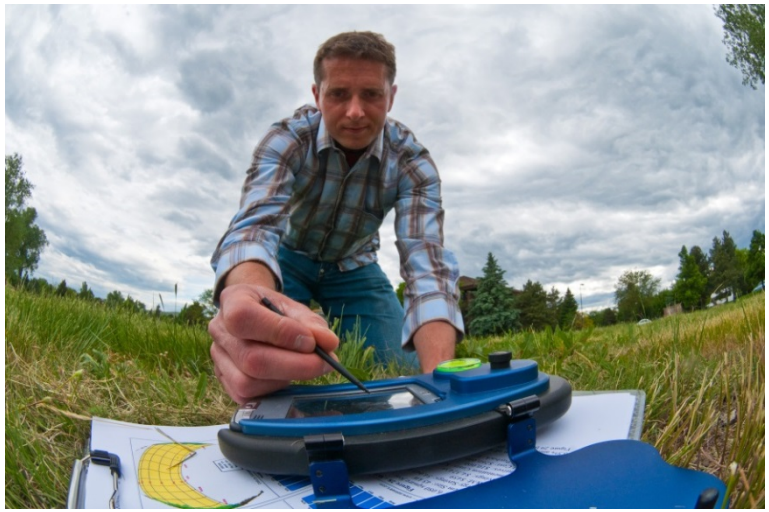
- ESPC, PPA, UESC, Appropriations

Execution

Project Development

- Transaction support and additional analysis





Miramar Summary

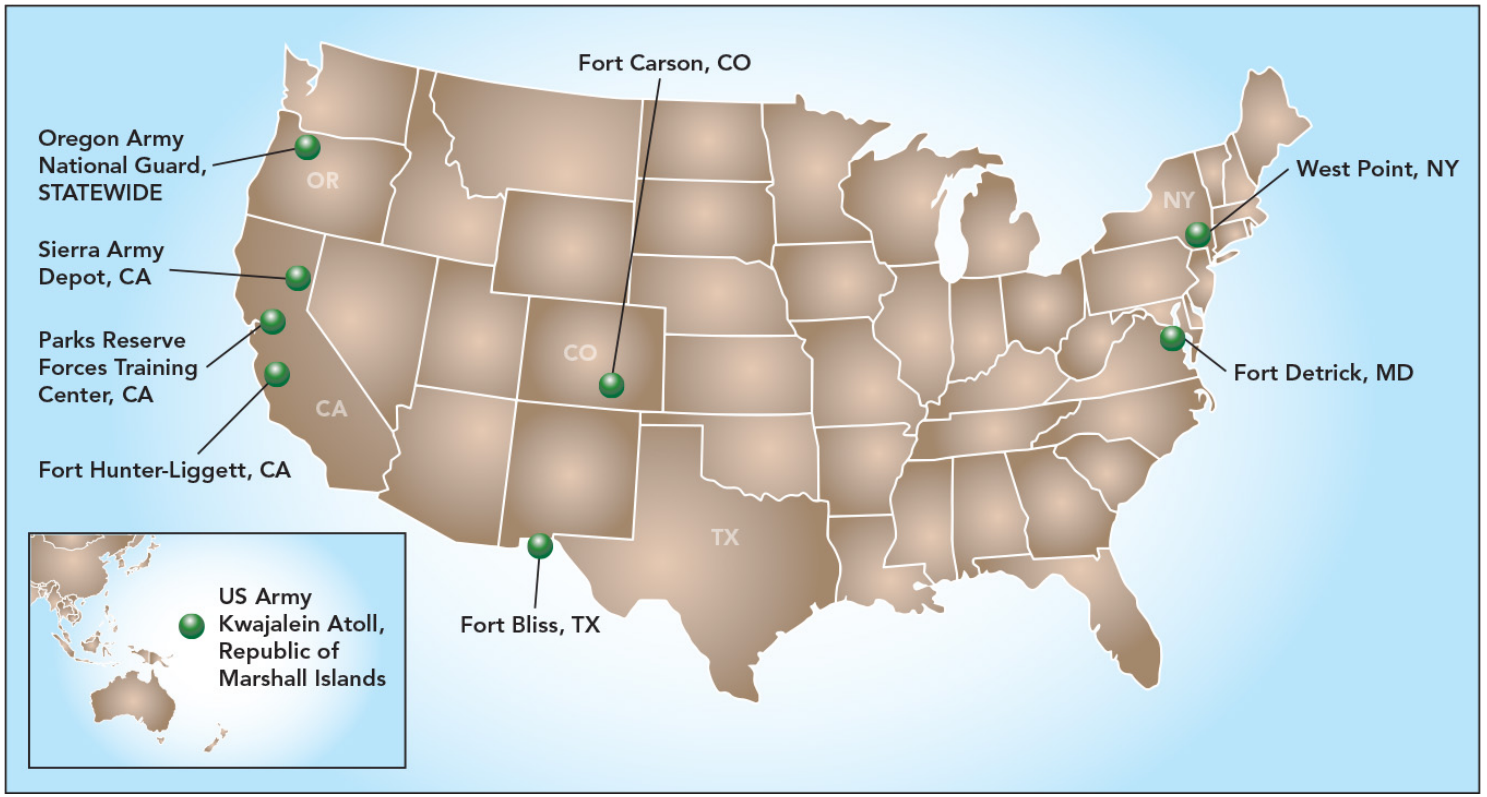
- **NREL completed NZEI assessment in 2010**

- **MCAS Miramar energy projects to date:**
  - Numerous energy efficiency projects
  - ~1.5 MW of solar PV plus solar parking lot and street lights
  - Solar thermal pool heating
  - 3 MW landfill gas PPA
  - ESTCP energy storage project
  - Currently approximately 50% renewable electricity

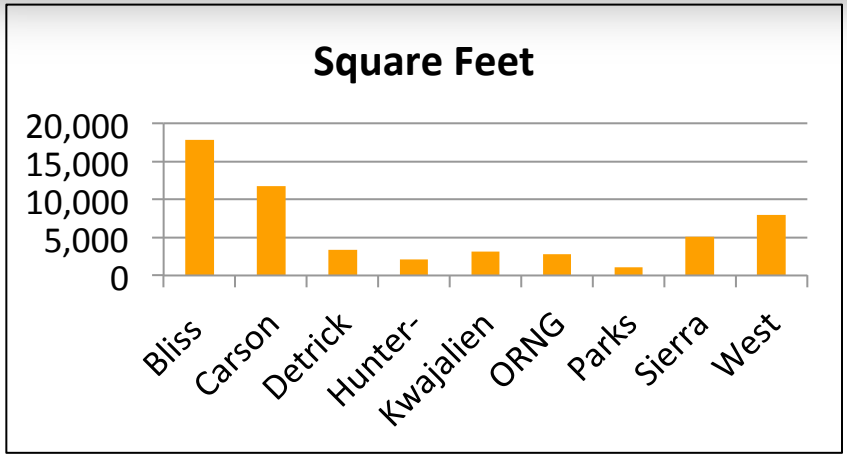
- **NREL completed microgrid assessment in 2012**
  - Conceptual design plan
    - Load analysis
    - Electrical modeling
    - Financial analysis
  - Project awarded construction funding

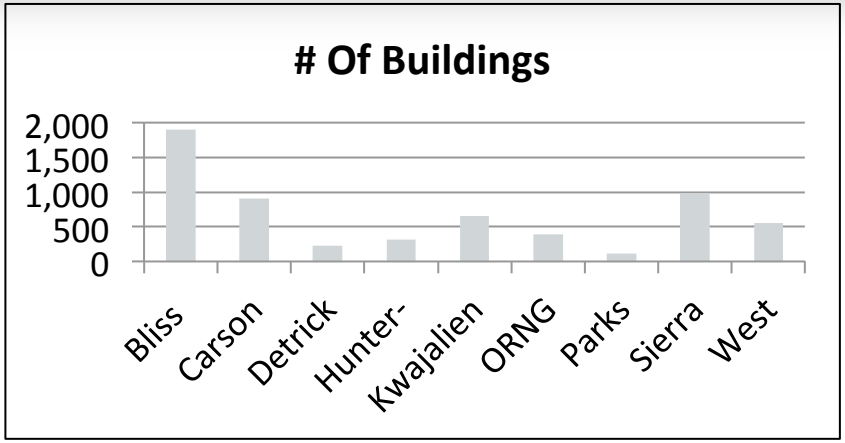
Army Net Zero Support

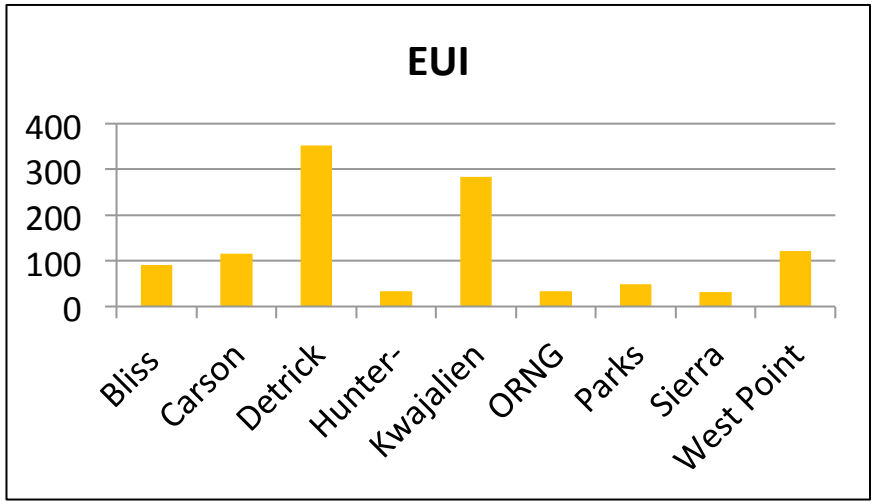
- FY11 Select installations
- FY12 Develop strategies
- FY13 and FY 14 Project Development

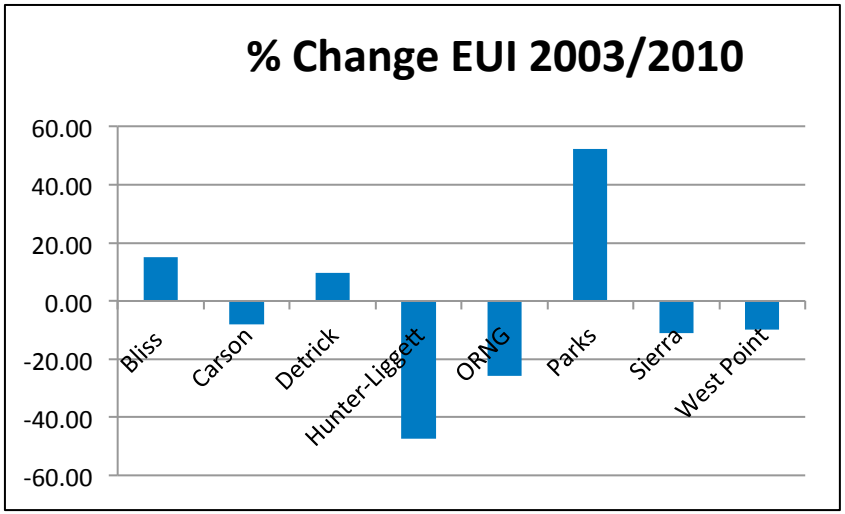


Army NZEI Real Property (One size doesn't fit all)



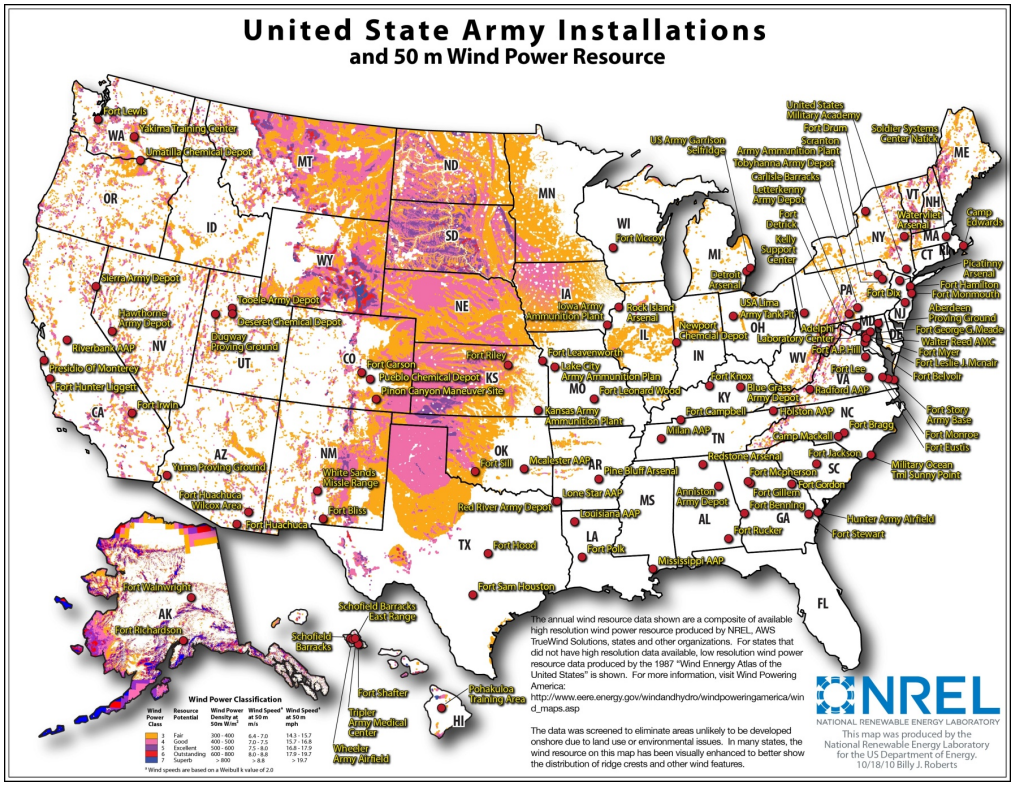


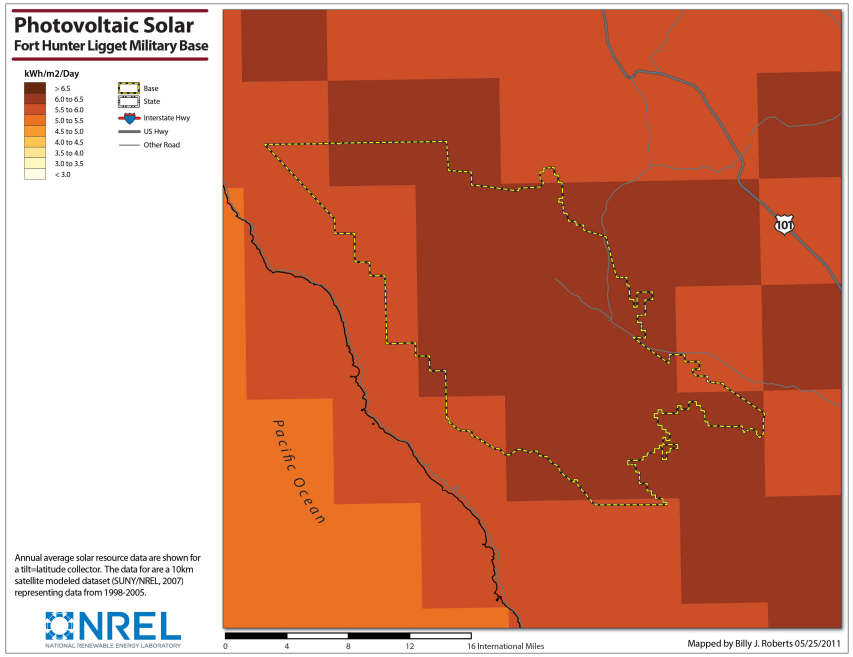




Net zero installation strategy is location dependent

Renewable Energy Resource Example

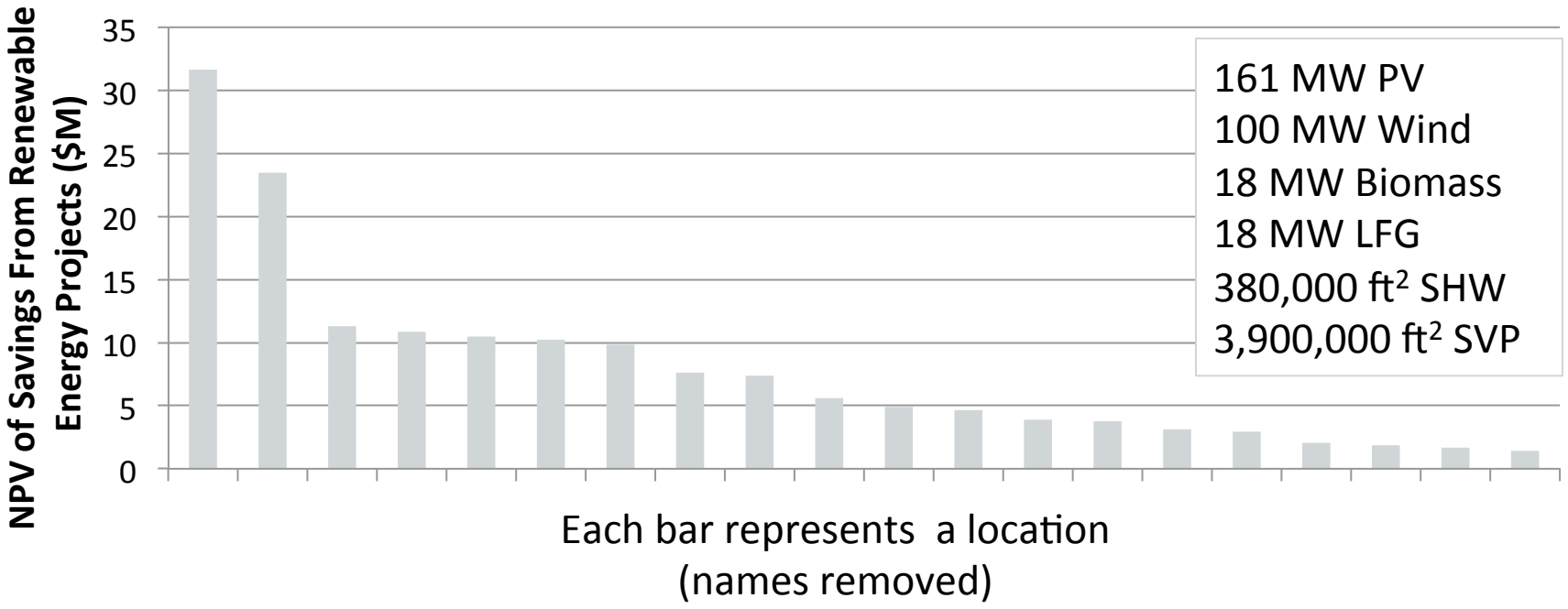




Portfolio Screening and Single Site Detailed Mapping

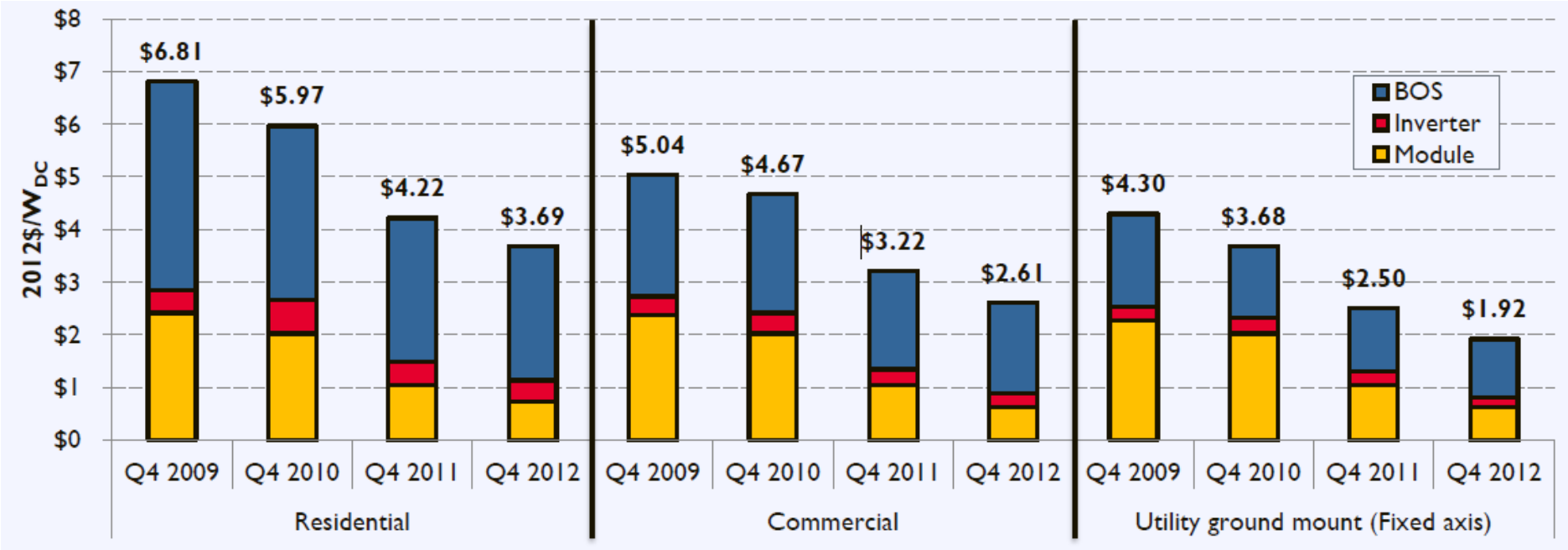
Portfolio Analysis Example

Agency Can Save $168M in Energy Costs Over 25 Years By Implementing RE



Portfolio analysis can help identify candidate locations for net zero

Solar Pricing
(Modeled Overnight Capital Cost of PV)



Solar price decreases of ~50% are making net zero more cost effective

Source: Photovoltaic System Pricing Trends: Historical, Recent, and Near-Term Projections *2013 Edition , NREL and LBNL*

New Construction Example: West Point

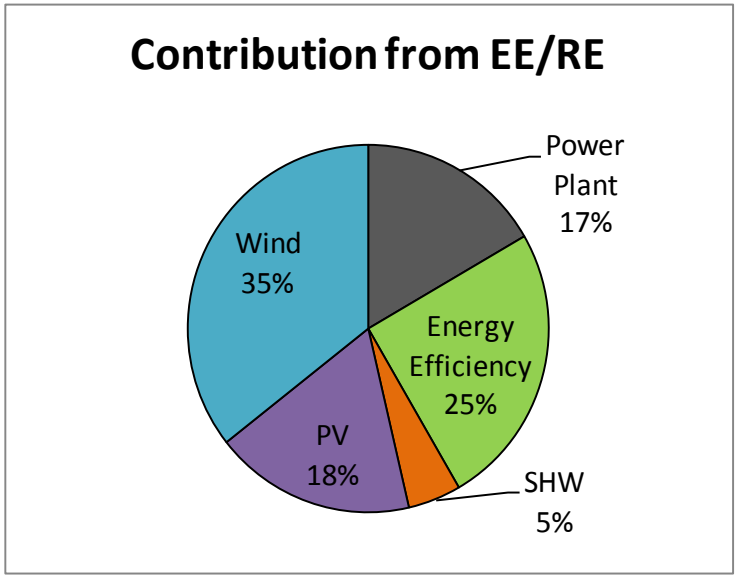
Table 5. Upcoming Construction and Renovation Projects at West Point	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017
Projects	Cadet Barracks Building	Scott Barracks Modernization	Camp Buckner, Phase 1 Barracks	Grant Barracks Modernization	Mac Short Barracks Modernization
	Waste Water Treatment Plant		Pershing Barracks Modernization		Mac Long Barracks Modernization
	Ammunition Supply Point		Camp Natural Bridge, Phase 1 Barracks		

New Construction can significantly increase baseline energy use but provides excellent opportunity for cost effective EE/RE projects

NZEI Example: Kwajalein

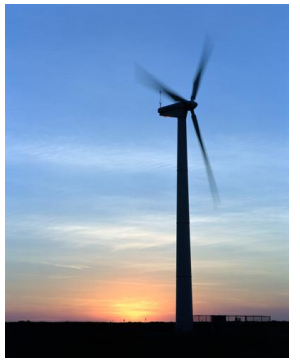
Phase 1 NZEI Strategy: (think strategy)

Total Initial Investment ($)	117,653,180
Annual Fuel Savings (gallons)	2,301,806
Annualized Fuel Cost Savings ($/ year)	10,012,806
Annualized RE O&M Costs ($/year)	–730,000
Base Case Life-Cycle Cost ($)	226,108,994
RE-diesel Case Life-Cycle Cost ($)	182,132,160
Life-Cycle Cost Savings ($)	43,976,816
Base Case LCOE ($/kWh)	0.281
RE Case LCOE($/kWh)	0.226

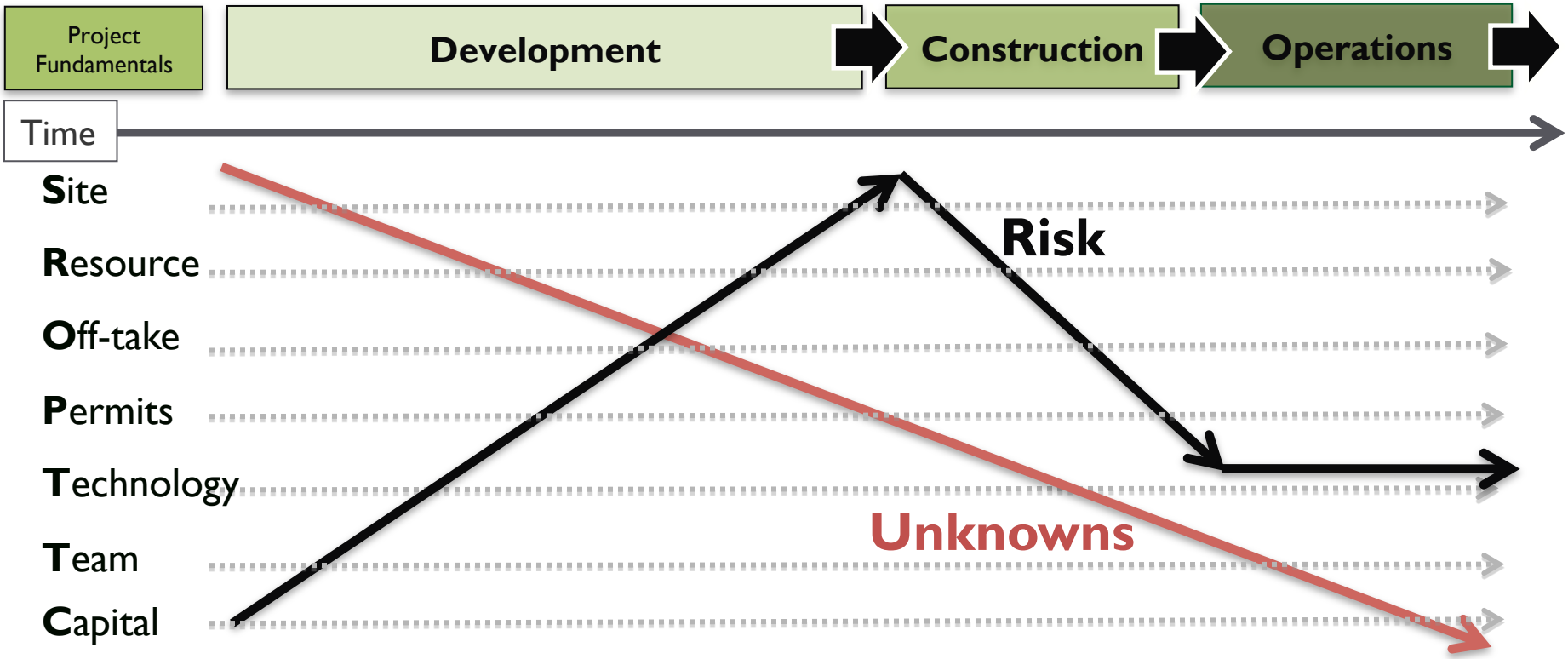


Phase 2: Project Development (think steel in the ground)

- **Cooling load analysis for seawater air conditioning**
- **ESPC project development support**
- **Wind met tower procurement, installations, and analysis**
- **Wind project sitting**
- **Solar PV and OTEC support**



Development Process



Support Example: Ft. Carson

Net zero report identified many possible projects and many key challenges such as low energy costs

Example Projects Supported

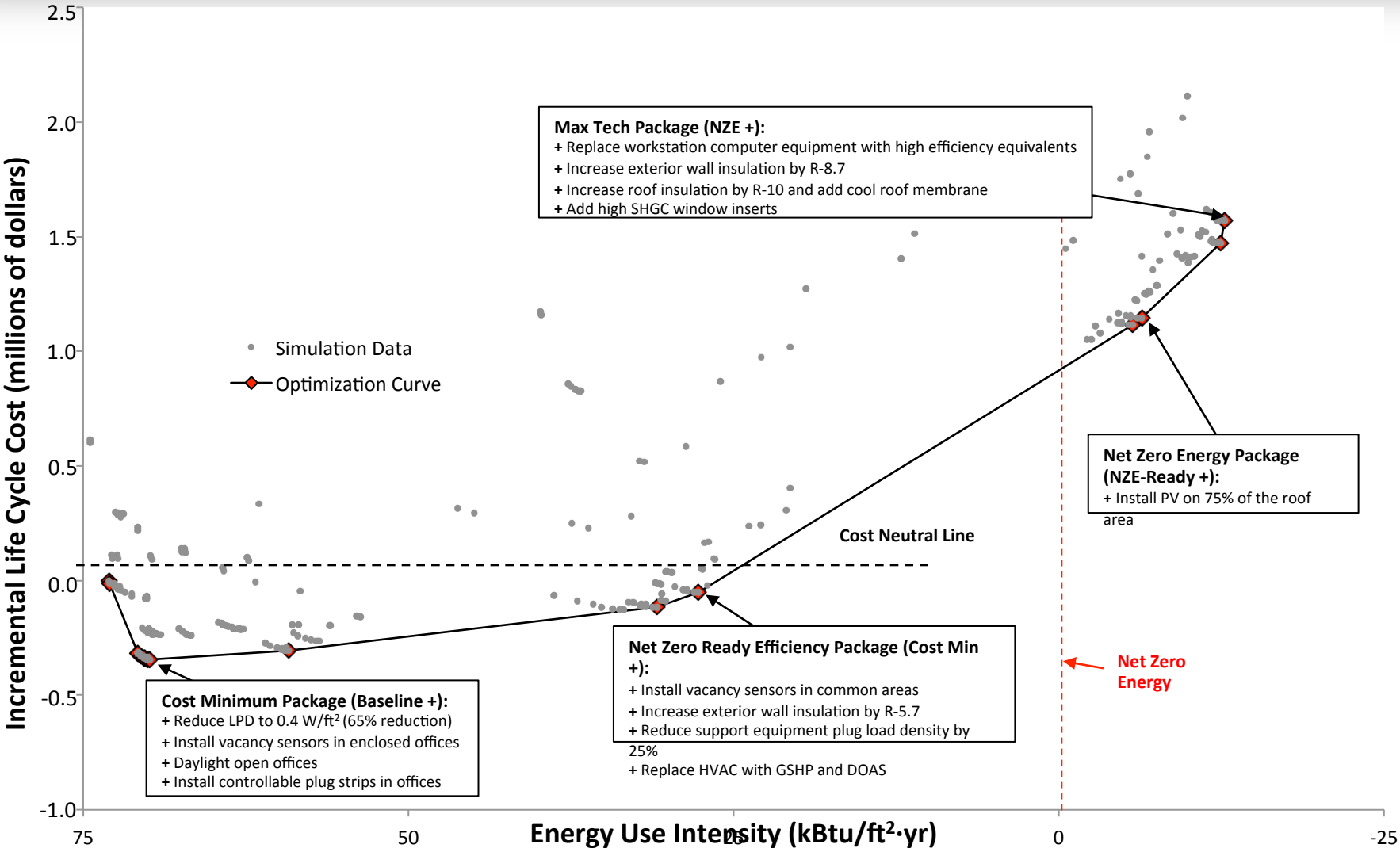
- Net zero building design support
- Biomass technical assistance
- Wind technical assistance
- RE operations and maintenance (O&M) guidance
- Energy conservation measures technical assistance
- Electric vehicle infrastructure strategy

Moving forward with many projects despite challenges

2 MW PV PPA

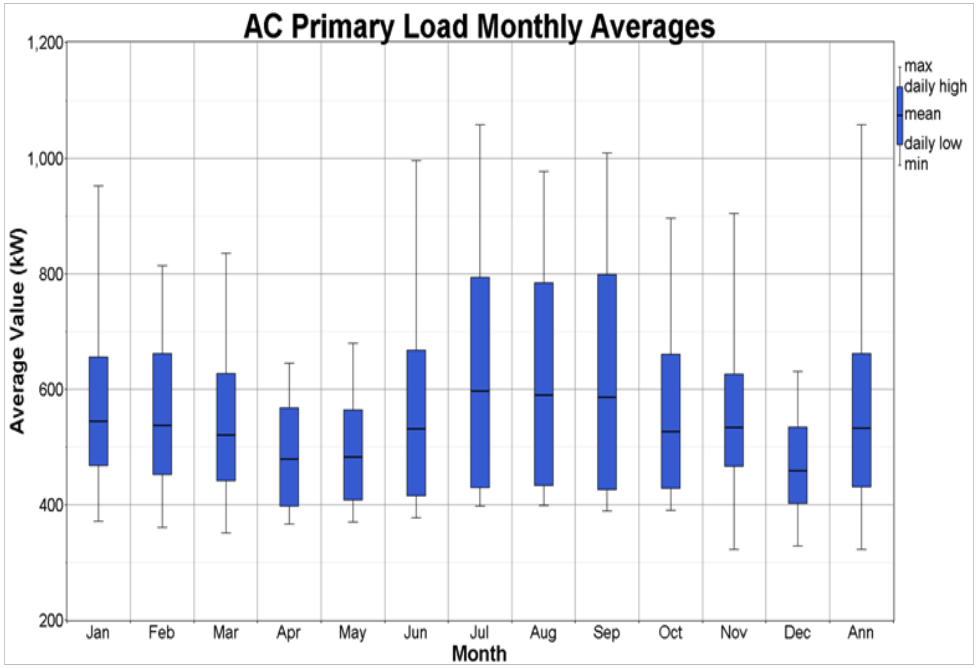
SVP Installed System

Ft Carson: Deep Dive Retrofit Study



Interconnection Example: Camp Parks

- 500 kW average load
- 4-5 MW PV needed for net zero
- Funded 2 MW PV project will export power
- CA has 1 MW net metering limit
- Expansion of feed in tariff to 3 MW helps



Installation can't interconnect enough PV to be net zero without utility involvement

Sample Projects to Date

- **Energy Efficiency**
  - Several ESPC's projects
  - Many smaller appropriations funded projects
- **Renewable Energy**
  - Numerous installed systems:
    - Solar PV, solar hot water, GSHP, etc.
  - Many projects in development
    - e.g. 18 MW PV at Ft. Detrick and 2 MW at Parks
- **Demonstrations projects**
  - Waste to energy, solar CHP, fuel cell, and biomass gasification

<u>Many</u> more projects needed to reach net zero!

Parks Fuel Cell Demo

FHL 1 MW Carport PV

Lessons Learned

- Net Zero does not equal energy security
- Goals and mandates require incentives and enforcement
- Behavior/culture change is also needed
- Construction designs need to sync with net zero goals
- Thermal NZE is the most difficult to accomplish
- Projects are difficult at many installations
- Implementation support is critical to success

An engaged and motivated team is the key differentiator

Thank You and Resources

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NREL Guide to Net Zero Energy Assessment:
http://www.nrel.gov/docs/fy10osti/48876.pdf

NREL Net Zero Energy Analysis for MCAS Miramar:
http://www.nrel.gov/docs/fy11osti/47991.pdf