

Charting a Course to Energy Independence

Providence, RI
August 9-12, 2009

**DoD-DOE Initiative-Net Zero Energy Installations:
Systems Approach to Energy Security**

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August 11, 2009





FEMP Mission

Facilitate the Federal Government's implementation of sound, cost-effective energy management & investment practices to enhance the nation's energy security





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Systems Approach

“Today, systems thinking is needed more than ever because we are becoming overwhelmed by complexity.”*

Systems approach premise

- Developing net zero buildings/communities/installations/campuses requires “systems thinking” (discipline for seeing wholes)
- Framework for understanding interrelationships rather than individual elements and seeing patterns of change rather than static snapshots

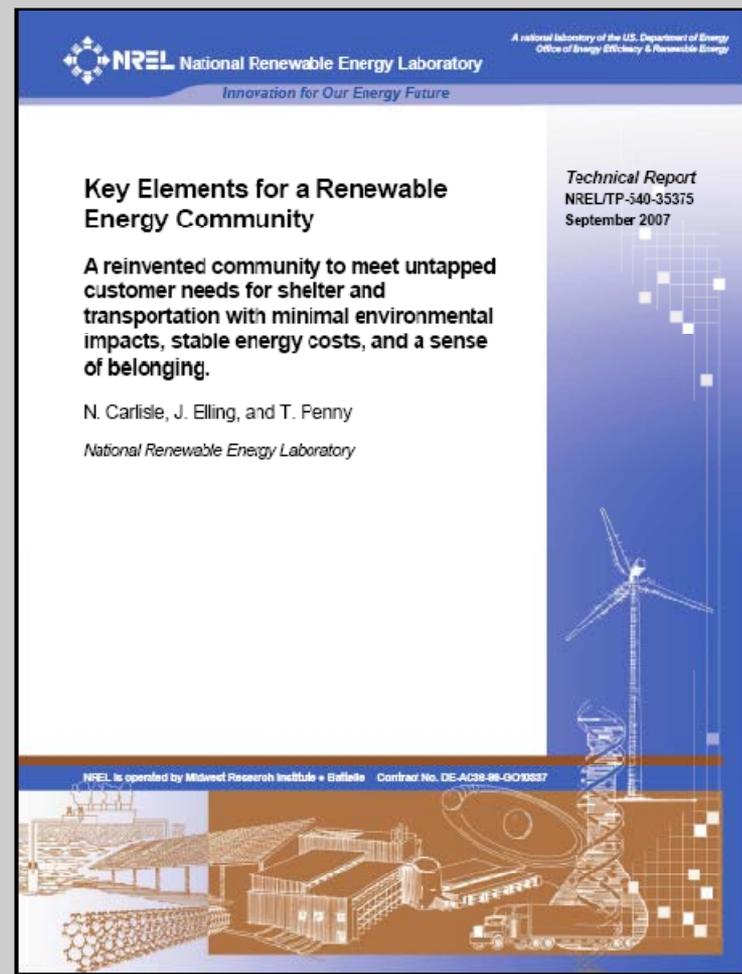
Supporting Considerations

- Progress will require more complex and integrated decision-making
 - Incremental approaches cannot be repeated indefinitely
 - Incremental improvements made in the absence of a long-term strategy can make deeper savings more costly or impractical
- Solutions require a combination of strategies; EE/RE technologies; linking values to human behavior; new roles for stakeholders and new public policy



Net Zero Energy Communities (NZEI premise)

- Based on Net Zero Energy Buildings (ZEB) concept
- Definition -
“A Net Zero Energy Community (ZEC) is one that has greatly reduced energy needs through efficiency gains such that the balance of energy needs for vehicles, thermal energy, and electric energy within the community is met by renewable energy.”
- Assumes community boundary and included energy uses
- Baseline energy use required to measure progress
- Place behavioral changes on par with technological changes





DoD-DOE Initiative

Objective: Identify specific actions that DoD and DOE can implement jointly that can have a material impact at DoD installations on energy demand and use of renewable energy

Members

- DoD Lead: Office of Secretary of Defense Energy (I&E)
- DOE Lead: Federal Energy Management Program (FEMP)
- Services (Air Force, Army, Navy/Marines)





DoD-DOE Initiative

Initial focus: Net Zero Energy Installations (NZEI)

- **Definition.** “A Military installation that produces as much energy (focus on renewable energy) on or near the installation, as it consumes in its buildings and facilities.”
- **Objective.** Create a repeatable template for planning and developing net zero energy installations across the Services
- **DoD Considerations**
 - Mission priority
 - Energy Security, surety and reliability
 - Diverse players
- **Approach**
 - Task Force (coordination and oversight)
 - Select pilot installations at each of the Services
 - Demonstrate (implement) this systems perspective at pilot sites



NZEI Task Force

DoD Members (primary)

OSD I&E-Brian Lally/CDR Brad Hancock

Air Force-Catherine Fairlie

Army-Don Juhasz

Navy-Chris Tindal

Marine Corps-Scott Houldsworth

DOE Members (primary)

FEMP- Richard Kidd (Program Manager)

Anne Crawley (FEMP Lead)

Bob Westby – NREL (Chair)

Participants

OSD Power Surety

DOE EERE HQ

OSD Sustainability



Approach: One site from each service to be selected as pilot

AIR FORCE (under consideration)

- Air Force Academy, Colorado
- Multiple other

ARMY (under consideration)

- Pohakuloa Training Area, Hawaii
- Multiple other

NAVY

- Multiple sites under consideration

MARINE CORPS

- MCAS Miramar, California
(selected as initial pilot site)





Approach: Site Assessment/Implementation Support

DOE centralized team
*Expertise in the NZEI areas**

- ✓ **Efficient building retrofits**
- ✓ **Efficient new buildings**
- ✓ **Renewable energy utilization**
- ✓ **Electric grid opportunities**
- ✓ **Fleets**

DoD forms/leads pilot site teams
Composed of the following

- ✓ Public works
- ✓ Energy manager
- ✓ Contracting & Legal
- ✓ Fleet Manager
- ✓ Base command

**Integrated NZEI suite of support software tools utilized*



Approach: Integrated NZEI Assessment Support Software Tools

- **Efficient building retrofits**
 - Pre-Engineering Analysis tool - systematic energy efficiency and renewable energy assessment
- **Efficient new buildings**
 - Opti-Plus (commercial buildings)- informs/optimizes design (energy modeling) process
 - B-Opt – counterpart tool for residential (base housing) applications
- **Renewable energy utilization**
 - Renewable Energy Optimization (REO) “tool” - preliminary screening to determine the least cost combination for facility RE (optimization process)
- **Electric grid opportunities**
 - Hybrid Optimization Model (HOMER) tool
 - Optimizes the system design by simulating various configurations of distributed energy resources
 - Simulates hour-by hour operation of the system and load profile to evaluate performance/lowest cost of energy
 - Distributed Engineering Workstation (DEW) tool-power flow analysis
- **Fleets**
 - Petroleum Reduction Planning (PREP) tool - optimal strategy recommendations utilizing efficiency improvements



Efficient Building Retrofits

“Load reduction is first priority”

Implementation pathways

- Energy Savings Performance Contracting (ESPC)
- Utility partnerships (Utility Energy Savings Contracts (UESC), Privatization)
- Appropriations (ECIP, EIP, ARRA, etc.)

Assessment support tools

- Pre-Engineering Analysis tool (energy efficiency and renewable energy assessment)
 - Integrated suite of automated, Excel-based calculation tools
 - Individual worksheets for Energy Conservation Measures (ECMs) or renewable energy projects
 - Worksheets (automated user forms) guide user through technological specifications for each ECM/project and provide cost guidelines
 - Allows facilities personnel to perform pre-engineering analysis
 - Comprehensive training available for Services personnel or subcontractors



Miramar Implementation Progress: Efficient Building Retrofits

- History of active energy conservation and efficiency implementation
- Comprehensive ESPC (new DOE IDIQ)
 - Reclaimed water
 - Distributed generation: cogeneration and Base- wide DG back-up
 - Control systems, HVAC retrofits, etc.
- Appropriations
 - High efficiency boilers Station-wide (\$7M ARRA)



Heat & Power, Peak Shaving
and Stand-by power





Efficient New Buildings

“Design to Net (or Near) Zero Energy use”

Implementation pathways

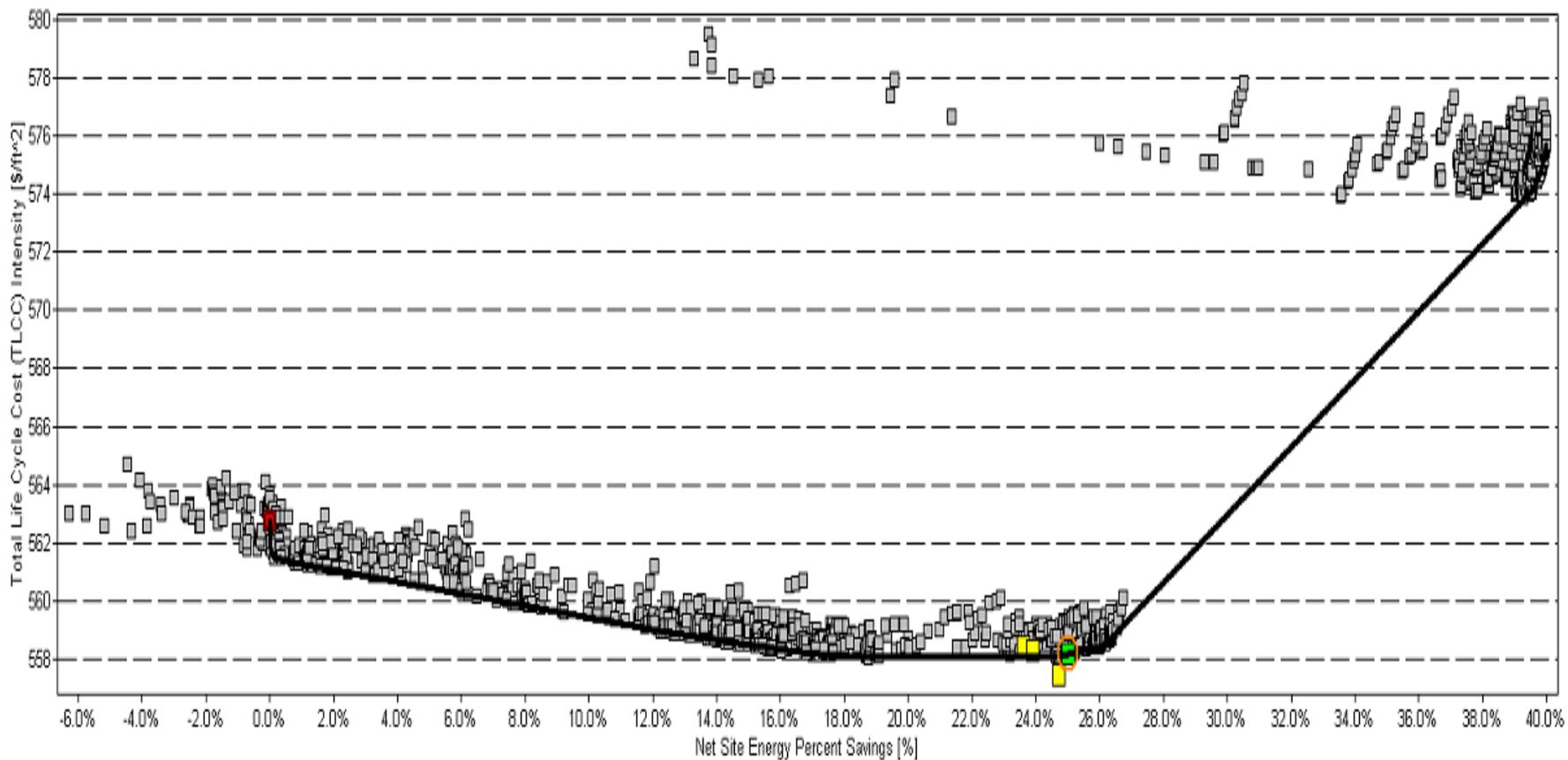
- Appropriations (MILCON, ARRA)

Assessment support

- Opti-Plus commercial buildings tool (informs/optimizes energy modeling process)
- B-Opt residential buildings tool (informs/optimizes design process)
- New Construction Guidelines (by building type)
- Technical assistance: Zero Energy Buildings (ZEB), LEEDS, etc.



Efficient New Buildings: Otpi-Plus (40% energy reduction goal for new Command and Control Facility, Ft. Shafter, HI)





Miramar Implementation Progress: Efficient New Buildings

- All buildings, at a minimum, will meet the Leadership in Energy Environmental Design (LEED) Silver certification level.
 - New Golf Course Facility - LEED Silver (certified)
 - New Training Pool/Facility- LEED Gold design goal



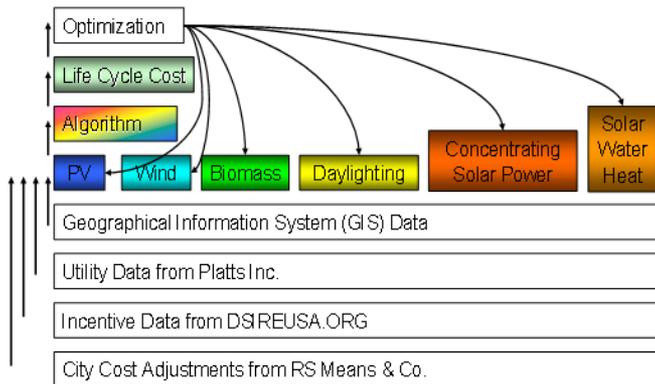


Renewable Energy Utilization

“Integrated, renewable energy technologies are primary NZEI energy supply”

Renewable Energy Optimization (REO)

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



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Innovation for Our Energy Future

Nellis AFB

Implementation pathways

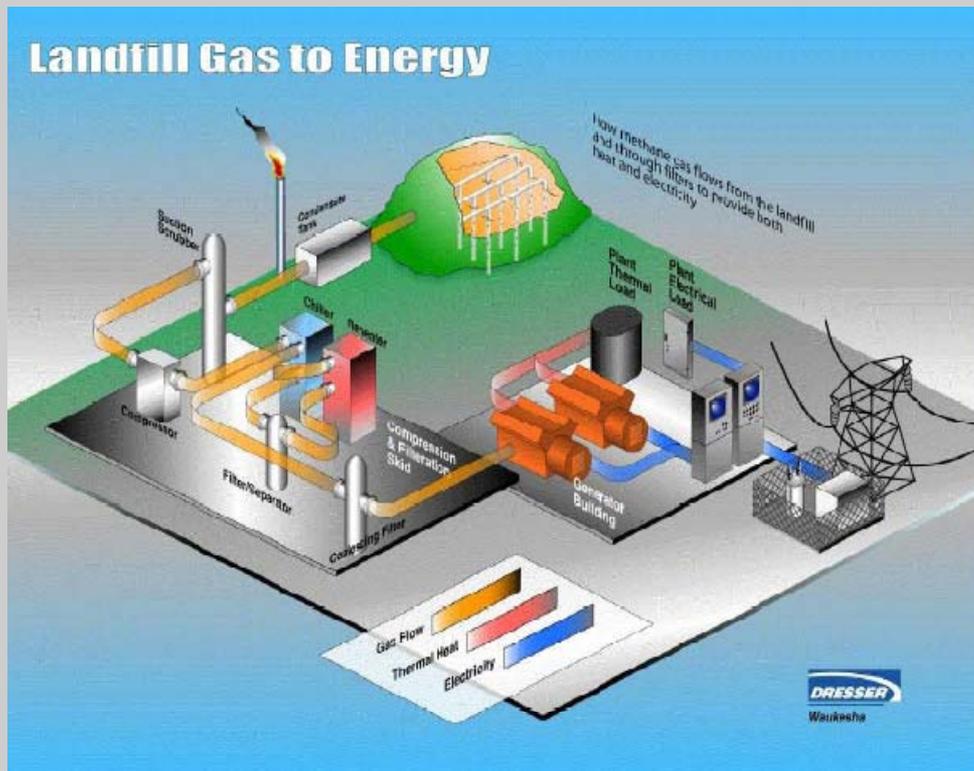
- Power Purchase Agreements (PPA)
 - Utilities (ITC)
- ESPC (Energy Services Agreement (ESA))
- Appropriations

Assessment

- Preliminary screening: Renewable Energy Optimization (REO) “tool”
 - Determines the least cost combination of renewable energy technologies for a facility (optimization process)
- Hybrid Optimization Model (HOMER)
 - Optimizes the system design by simulating various configurations of distributed energy resources
 - Simulates hour-by-hour operation of the system and load profile to evaluate performance/ lowest cost of energy



Miramar Implementation Progress: Renewable Energy Utilization



- Land Fill Gas (LFG) Power Purchase Agreement (PPA)
 - Three (3) MW (25,000 MWh/year) from contiguous landfill
- Appropriations
 - ECIP: 700-800 kW PV
 - ARRA (150 kW PV car port and PV street lights, solar hot water with all new boilers and solar hot water heating (2 hangars))



The Distribution Grid Opportunity ("Paradigm shift to Smart Microgrids")

* Defense Science Board Report:

"Critical missions are at a high risk from failure of the grid."

- "In the past 50 years, the electric power system (grid) has starved of innovation despite significant increases in consumer demand—one solution is to expand the role of smart microgrids that interact with the bulk power grid but can also operate independently: *"Galvin Electricity Initiative, Smart Microgrids"*
- Distribution grids transformed from passive to active networks
 - Decision making and control is distributed
 - Power flows bi-directional
- New requirements for distribution grids
 - Accessible to distributed generation and renewables (self-dispatched or locally dispatched)
 - Enabling local demand management interacting with end users through smart metering systems
 - Benefits transmission dynamic control techniques and overall level of power security, quality, reliability and availability



Energy Security Opportunity: Microgrids



“Distribution level optimization of the supply and use of energy facilitated by microgrids is key to Energy Security”

Implementation pathways (facilitation of the systems approach)

- Integrated approach to microgrid implementation including distributed energy resources, controls, grid interconnection and energy use optimization

Assessment

- Identify and characterize
 - Base distribution system (“microgrid”) infrastructure supply
 - Load characteristics (size and time of occurrence)
- Assessment tools
 - HOMER (micropower optimization model)
 - Distributed Engineering Workstation (DEW)-power flow analysis



Miramar Implementation Progress: Microgrid

Miramar Goal: “Intentionally Island” for Emergency Conditions

- Microgrid baselining and assessment
 - One line electrical diagram
 - HOMER assessment
 - DEW assessment
- Distributed Energy Resources implementation “benchmark”
 - Electrical load: 50,000 MWH/yr, 6 MW (average demand)
 - Distributed Energy Resources
 - Renewables (LFG- 3 MW/25,000 MWH/yr, PV, SHW)
 - Fossil (CHP-2.5MW/? MWH, D-G 5 MW (estimate))
- Controls (Microgrid level-pending, systems level (ESPC))
- Grid interconnection (discussion with SDG&E)
- Demand response (discussion with SDG&E, private sector option)

Microgrid implementation - NREL concept advisor role



Fleet and Infrastructure (Non-Tactical Vehicles)

“Convert NTV fleet to electric vehicles (EVs) and flex fuel vehicles along with required fueling/recharging” infrastructure”

Implementation pathways (Appropriations)

- Net Zero applications (electric vehicles (EVs), PHEVs, neighborhood EVs) and Vehicle-to-Grid (V2G)
 - Fleet of EVs/PHEVs is distributed energy resource option
- Recharging infrastructure (renewable energy electric recharging sources)

Assessment

- Required data: vehicle inventory, year of purchase, vehicle miles traveled (VMT) and fuel use data
- Provide optimal strategy recommendations utilizing Petroleum Reduction Planning Tool (PREP))
 - Efficiency improvements
 - Fuel switching
 - Switch to hybrid or all-electric vehicles
 - Changes in use/right sizing

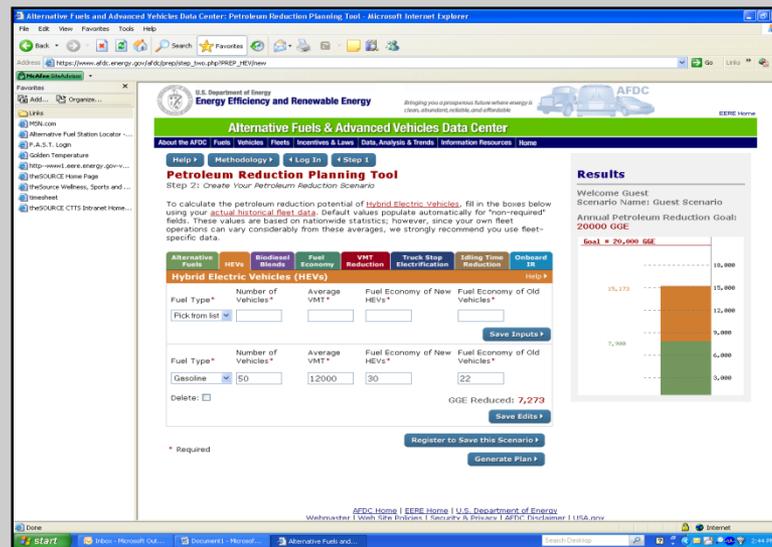


PV Recharging Station



Miramar Progress: Fleet and Infrastructure

- Biodiesel/compressed natural gas on site and in use(E85 pending)
 - Nearly 30% of vehicle fleet fuel used was alternative fuel
 - Large number of AFVs/NEVs in inventory
- Vehicle inventory and fuel use data received and strategic assessment pending

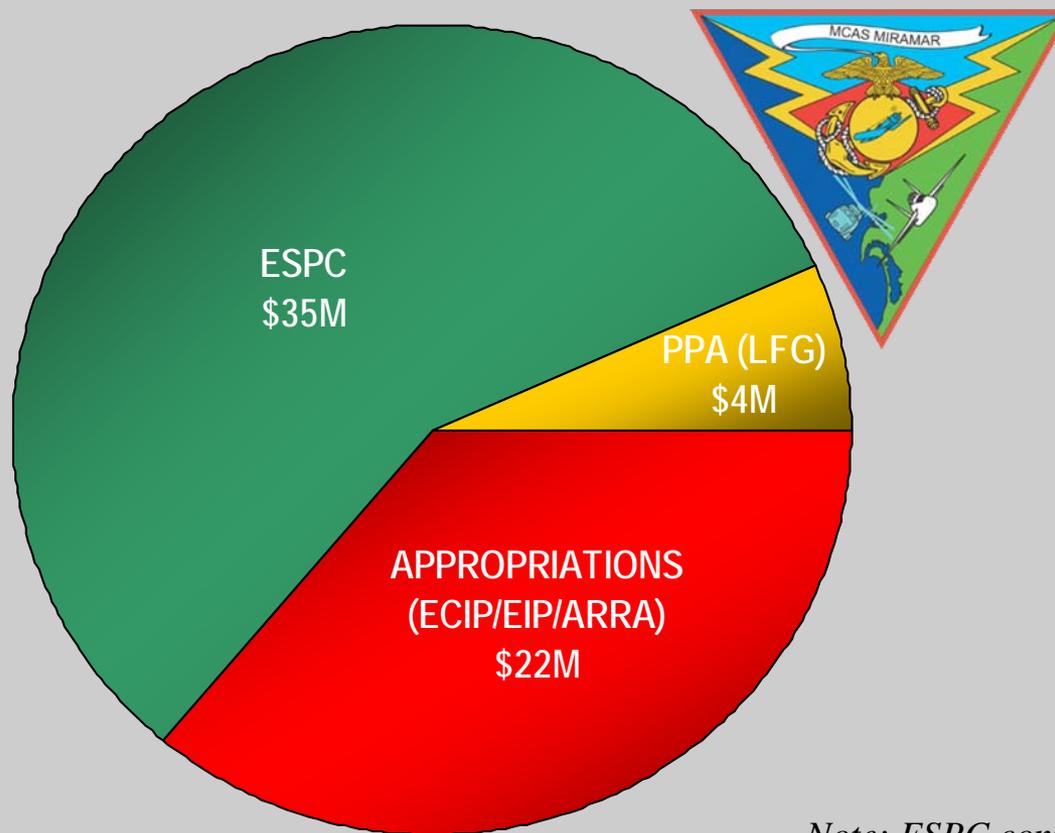


Opportunity: Alternative fuel use and petroleum reduction mandates focus on 0.5% of total Miramar fuel use.



Initial NZEI Pilot Site: Miramar Funding Sources

**Current Appropriated and Leveraged Funding -
\$61M (estimate)**



Note: ESPC contract value pending



Thank You! QUESTIONS?

For more information:

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