Mission Driven Energy Security and Environmental Stewardship

ESIP Winter Meeting Washington DC 4-6 January, 2011

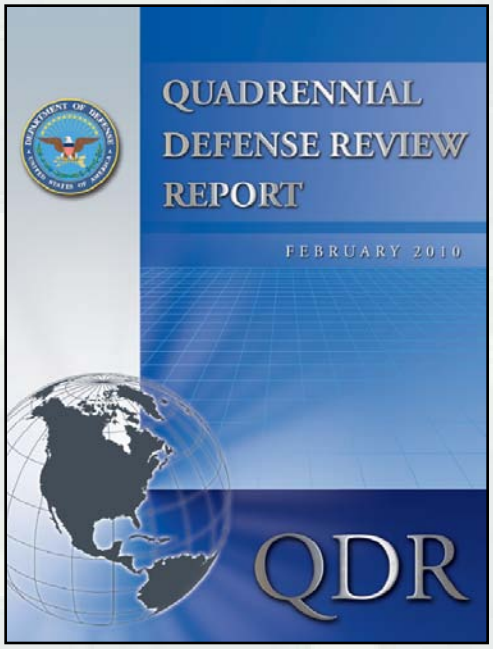
Harold R. Sanborn
Energy Program Manager

U.S. Army Corps of Engineers

4 JAN 2011

Quadrennial Defense Review

FEB 2010



Focused on four specific issues where reform is imperative:

- security assistance
- defense acquisition
- defense industrial base
- **energy security** and climate change

Energy Security – "*assured access to reliable supplies of energy and the ability to protect and deliver sufficient energy to meet operational needs*"

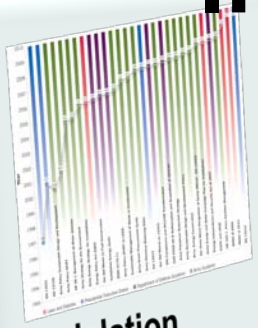
- DoD will
  - promote investments in energy efficiency
  - ensure that critical installations are adequately prepared for prolonged outages caused by natural disasters, accidents, or attacks
- Design balance into energy production and transmission to preserve test and training ranges and operating areas needed to maintain readiness

" **Energy efficiency** *can serve as a force multiplier, because it increases the range and endurance of forces in the field and can reduce the number of combat forces diverted to protect energy supply lines…*"

- DoD will fully implement the energy efficiency Key Performance Parameters and fully burdened cost of fuel into systems

QDR energy security discussion is consistent with Army approach and priorities

Army Energy Security Implementation Strategy



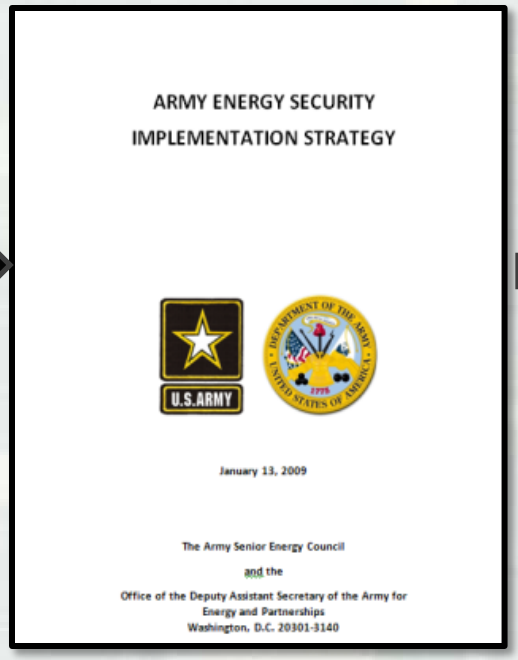
Legislation
- EPAct 2005
- EISA 2007
- NDAA

Executive Order
- EO 13423

OSD Policy
- DODI 4170.11, DOD Managers Handbook

Army Policy
- AR 420-1
- Army Energy & Water Campaign Plan

EO 13514



ARMY ENERGY SECURITY
IMPLEMENTATION STRATEGY

U.S.ARMY

January 13, 2009

The Army Senior Energy Council
and the
Office of the Deputy Assistant Secretary of the Army for Energy and Partnerships
Washington, D.C. 20301-3140

Currently 57 Metrics

Energy Security Goals (ESGs)

1. Reduce Energy Consumption
2. Increase Energy Efficiency Across Platforms and Facilities
3. Increase Use of Renewable/ Alternative Energy
4. Assure Access to Sufficient Energy Supplies
5. Reduce Adverse Impacts on the Environment

Procedures to Evaluate Sea Level Change Impacts, Responses, and Adaptation

Engineering Technical Letter Team

External Experts

USGS (Robert Thieler, Nate Plant)
NOAA (Steve Gill, Billy Sweet, Kristen Tronvig)
Bureau of Reclamation (Mike Tansey)
FEMA
Navy (Tim McHale, Shun Ling)
FHWA (Kevin Moody)
HR Wallingford, UK (Jonathan Simm)
University of Southampton, UK (Robert Nicholls)

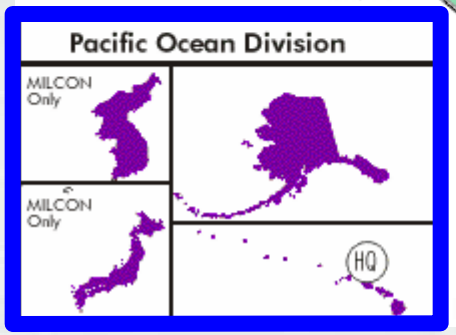
Mike Mohr, LRB

John Winkelman, NAE
Jeff Gebert, NAP
Larry Cocchieri, NAD and PCX

Heidi Moritz, NWP Team Lead for Engineering

Henri Langlois, IWR
Team Lead, Planning
Jeff Arnold, IWR
Lauren DeFrank, IWR
Brian Harper, IWR
Rolf Olsen, IWR
Kate White, IWR

Stu Townsley, SPD



Mike Wutkowski, SAW

Matt Schrader, SAJ
Glenn Landers, SAJ
Mark Shafer, SAJ

Susan Rees, SAM
Dennis Mekkers, SAM
Patrick O'Brien, MVD

Justo Pena, SWG

Julie Rosati, ERDC
Andy Garcia, ERDC

Tom Smith, POH
Crane Johnson, POA

BUILDING STRONG®

U.S. Army Corps of Engineers
Strategic Sustainability Performance Plan

(Executive Order 13514-*Federal Leadership in Environmental, Energy, and Economic Performance*)

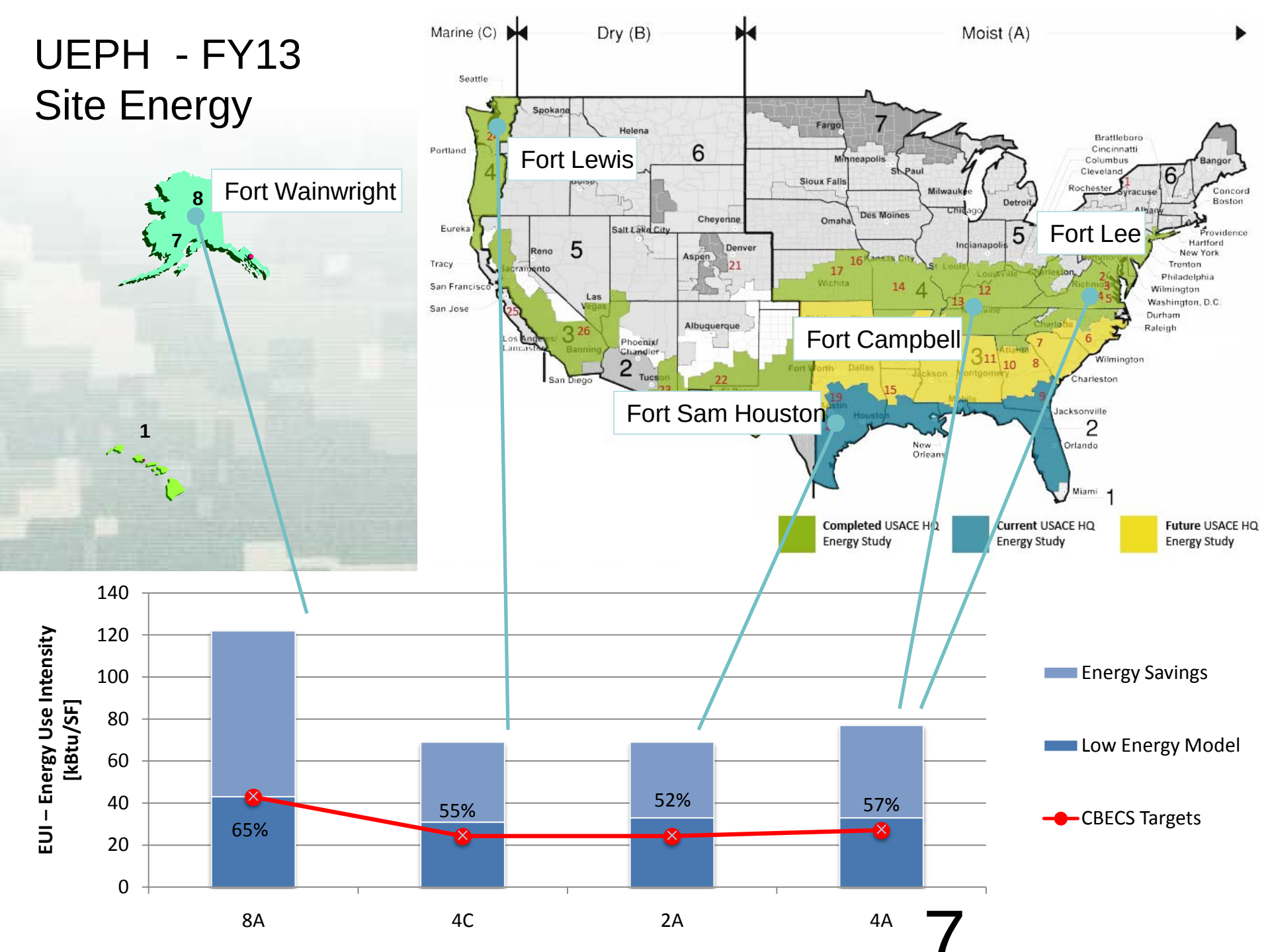
Ten Goals

1. 23 percent reduction target for greenhouse gas Scopes 1 and 2 emissions by 2020
2. 5 percent greenhouse gas reduction target for Scope 3 emissions by 2020
3. Develop and maintain a comprehensive greenhouse gas inventory
4. Implement “Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings”
5. Engage in regional and local sustainable planning efforts
6. Improve water use efficiency and management
7. Prevent pollution and waste
8. Improve sustainable acquisition practices
9. Improve electronic stewardship practices (energy efficient data centers)
10. Implement innovative sustainable practices relate to core mission areas

Improving Building Performance

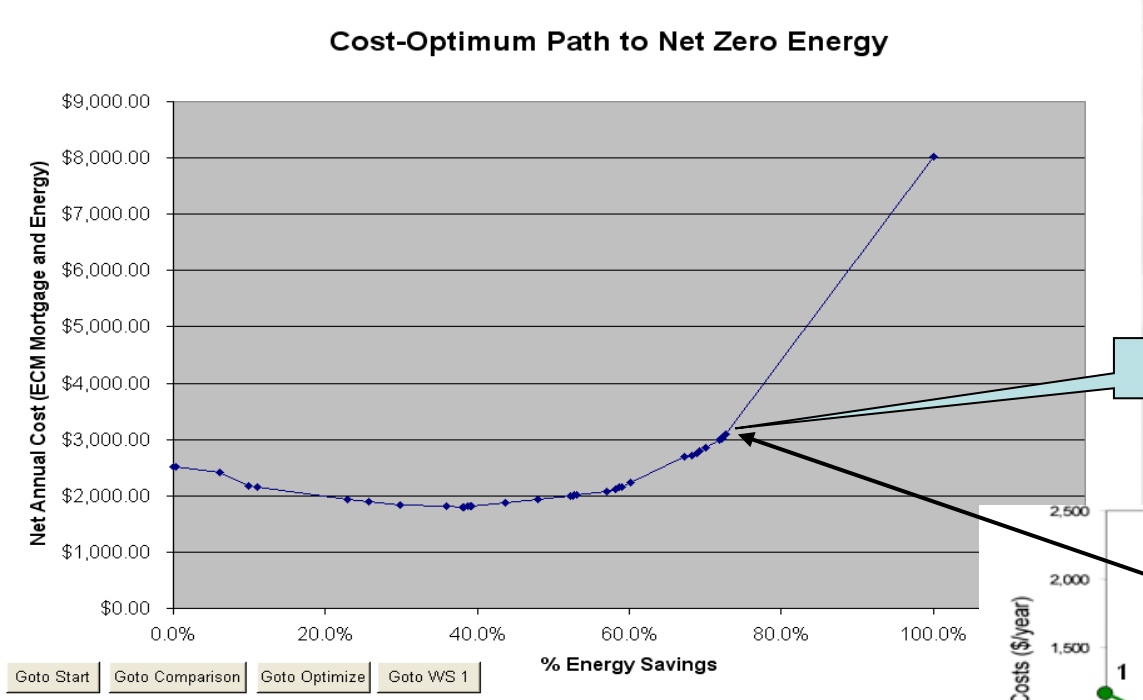
- Energy Targets for Different Building Types
- Recommendations:
  - Adjust project scope to include enhanced energy performance and select LEED credits
    - Raise energy reduction baseline to 40 percent (ASHRAE 90.1 -2007)
    - Project scope to include select LEED credits
    - Require LEED certification at level Silver
- Path to compliance – new construction
  - USACE HDQTRS, COS, ERDC and CERL joined to perform life cycle cost on known technologies
  - Starting with the FY13 program - creating an “energy enhanced 1391 for HDQTRS Bldgs, COF’s, TEMF’s, Barracks and Dining facilities
  - Initial goals target a nominal increase of 10 percent cost to achieve:
    - 65 percent energy saving over ASHRE 2010
    - 30 percent water reduction
    - 50 percent wastewater reduction
    - 25 percent reduction in operating cost
    - Net Zero ready
    - Comply with executive orders and laws

UEPH - FY13
Site Energy

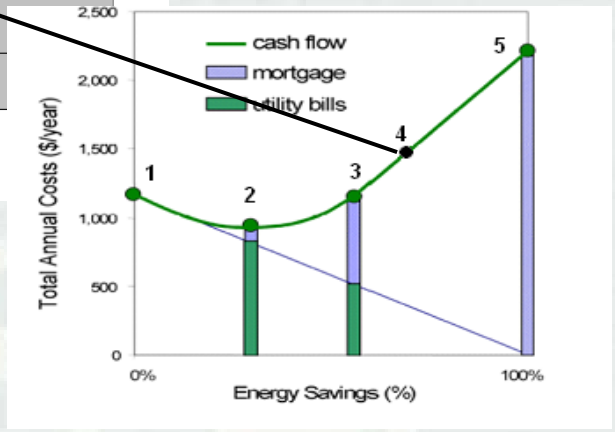


Improving Building Performance

Building Simulation – CERL model



NZE Ready Point



Major Army Energy Initiatives
Potential for Partnerships

- **"Net Zero Energy"** through implementation of on-site renewable energy generation, reduced energy consumption and improved energy efficiency.
  - **By end of FY12, five installations designated to become "Net Zero Energy" by FY21**.
  - **Twenty-five installations designated by end of FY14 to become "Net Zero Energy" by FY31**
  - **USACE lab designated to lead Joint Concept Technology Demonstration for a smart grid program**

- **Field "smart grid" technologies for non-traditional installations (forward operating base camps).**

Smart-grid capabilities will increase the energy security of operational forces with more efficient use of traditional power Generators and the capability to capture and distribute energy from the sun and wind.

Example Energy Security Projects

- BLACK: Existing System
- BLUE: Planned Project
- RED: Development or Testing Project

Renewable Energy Summary

TOTAL PROJECTS – 66 +

363 Million Btu = Renewable Energy Generation

(23.8 GWH = Renewable Electricity)

Hawthorne Army Depot, NV
(Geothermal Power, ECIP)

Camp Williams, UT
(Wind Power, ECIP)

Fort Carson, CO *(Solar PV Array, PPA)*

Fort Drum, NY
(Solar Wall, ECIP)

Fort Knox, KY
(Ground Source Heat Pumps, UESC / ECIP)

Fort Irwin, CA
(Solar power, EUL)

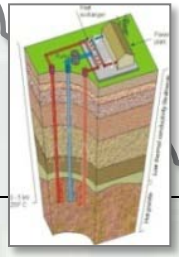
Fort Sill, OK
(Micro-grid Field Demonstration

Fort Jackson, SC
(Fuel Cells, RDT&E)

Fort Bragg, NC
(LEED Platinum Bldg ESTCP/ITTP)0

Fort Huachuca, AZ
(Rooftop PV, ITTP)

Fort Bliss, TX
(Geothermal Well Tests,



FUNDING SOURCES:

- **EUL:** Enhanced Use Lease
- **ITTP:** Installation Technology Transition Program
- **ECIP:** Energy Conservation Investment Program
- **UESC:** Utility Energy Service Contract
- **PPA:** Power Purchase Agreement

BUILDING STRONG®

Engineering Energy Security

Dispensing

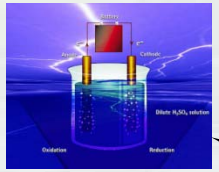
Electric Grid

Electric and Diesel-Electric Hybrid Vehicles

Base Vehicles

Pump

Tanker



B20 Bio-diesel

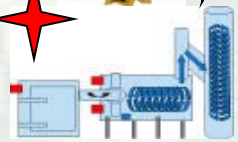
Production

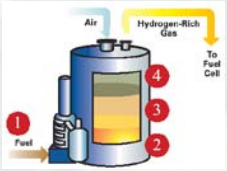
Dispensing

Hydrogen Dispenser

Grid and Alternative Energy Generate H_2 via Electrolysis

Wind and Solar Power Provide Electricity



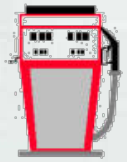


Natural Gas and Biomass are Reformed to Produce Hydrogen

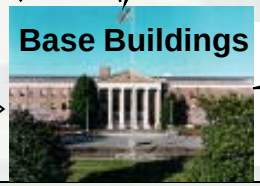
Biomass Gasification used for Power and Heating

Electric Grid

Dispensing



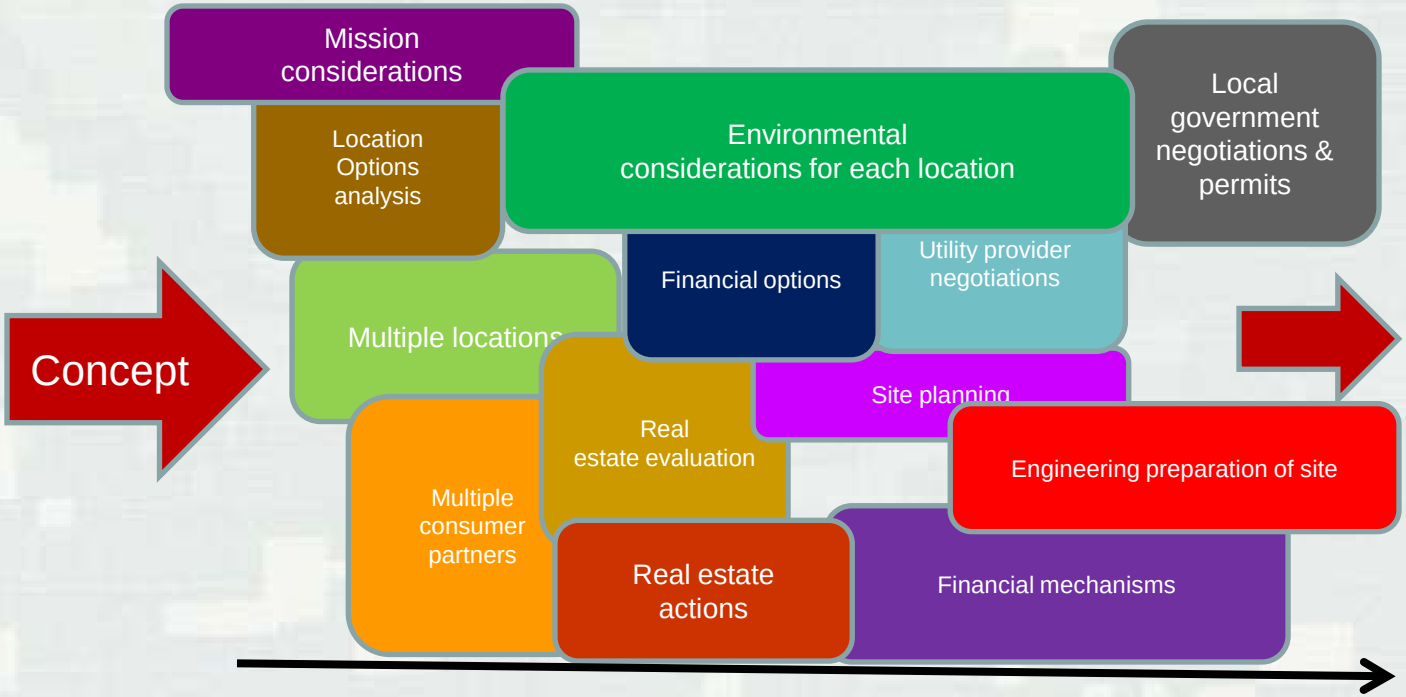
Natural Gas



Base Buildings

BUILDING STRONG®

Reducing Complexity and Time between Concept and Energy Production



Providing appropriate guidance and expertise to assist with planning, project approvals, and operations would helps avoid delays and failures, and get renewable energy projects in production more quickly

Way Forward

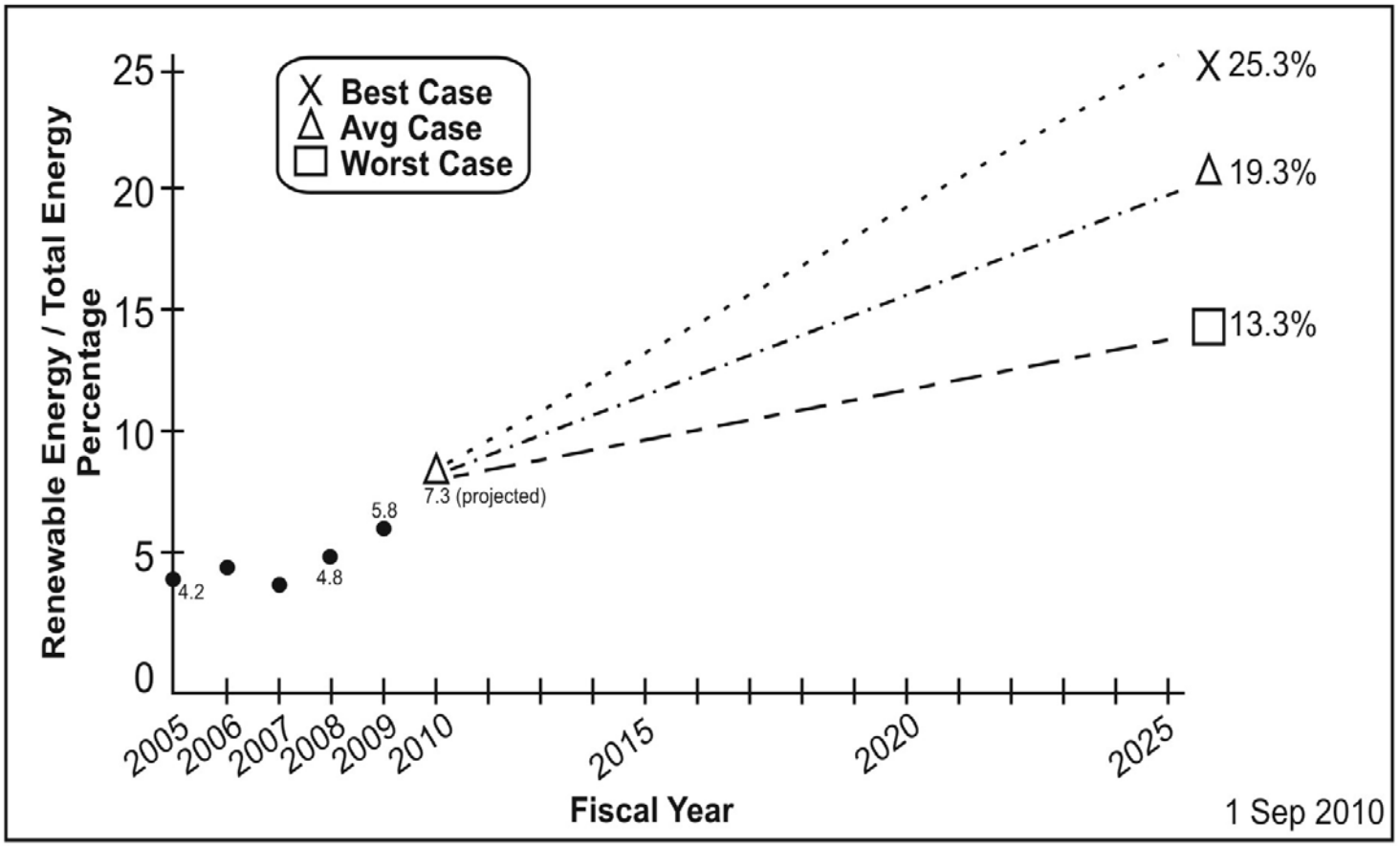
- **Improve planning at corporate and local levels**
  - **Defense level coordination**
  - **State and regional coordination**
  - **Industry coordination**
  - **Demonstrations**
- **Provide "toolbox" of financial and real estate capabilities designed for renewable energy projects**
- **Undertake necessary studies to improve success and reduce conflicts with projects**
- **Mix portfolio to achieve goals**
  - **On site small scale (rooftop PV, etc)**
  - **On site (nearby?) large scale projects**
  - **Renewable Energy Certificates**

2 Megawatt Solar PV Site at Ft. Carson, CO

Integration and Synchronization

- **Planning needs at corporate level (e.g. where are the best locations to field large systems, who all might be stakeholders, what coordination is needed with utility industry, etc) as well as local level**
- **Numerous delays have been experienced with implementation of renewable energy – especially larger scale systems**
- **Expertise (renewable, planning, environmental, real estate, contracting, etc) exists to address all the planning problems – not brought together early enough in the planning process to reduce avoidable delays and problems**
- **Additional guidance is needed to help energy managers (and supporting organizations) walk though all the steps**

Defense Goal - 25% by 2025



Data reported from services for 2005-2009, projections for 2010 to 2025. Significant increase in 2011 projected from stimulus funding

Meeting the Renewable Goal

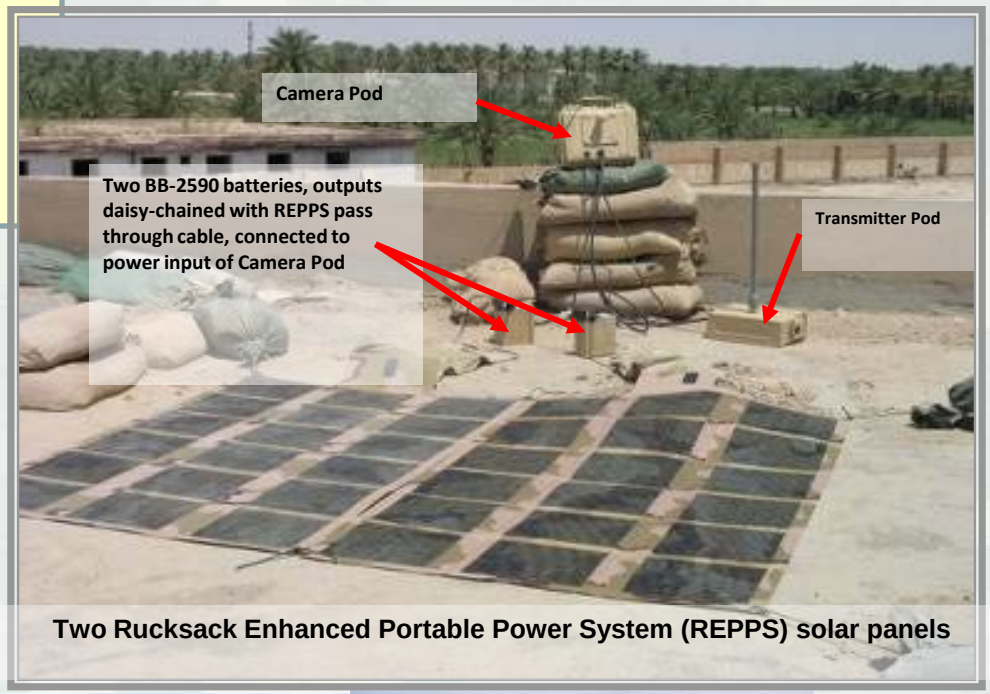
- **Solar**
  - **10 Kilowatt (KW) PV system $60K installed**
  - **100 KW PV system would cost about $430K installed**
  - **1 Megawatt (MW) PV system would cost about $3.25M installed**
- **Wind**
  - **10 KW wind turbine would cost about $72K installed**
  - **100 KW wind turbine $500K installed**
  - **1 MW wind turbine $2.5M installed**

To reach 25% by 2025, & keep costs down, significant Defense renewable investments need to be large scale – Enterprise/installation solutions

Operational Energy Possibilities
Operational Success

The Challenge:

- **Fuel logistics, management and protection are key for contingency operations success**

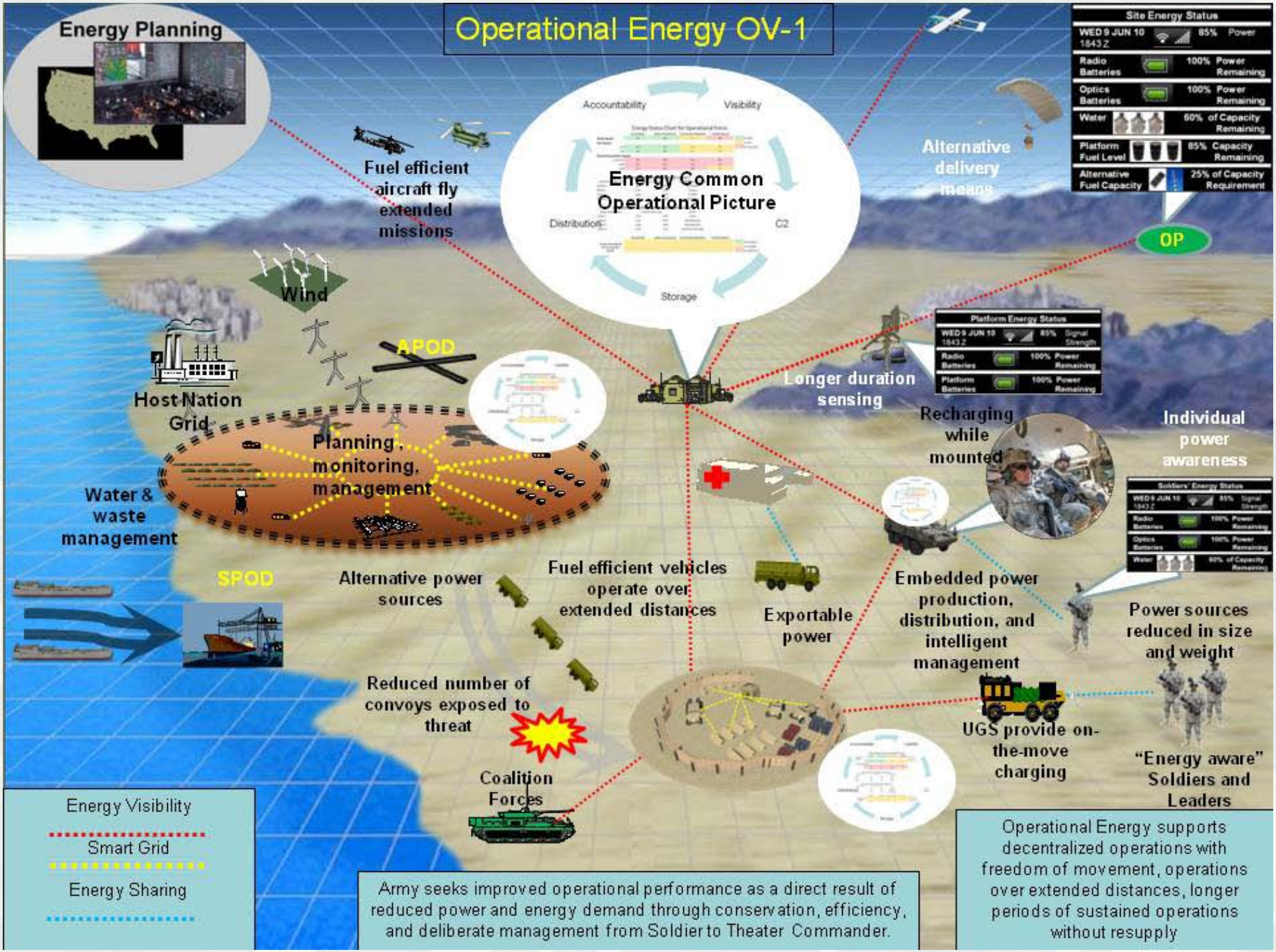


Two Rucksack Enhanced Portable Power System (REPPS) solar panels

Key Energy Opportunities

- **Tactical Grid Management**
- **Distributed Generation**
- **Renewable/Alternative Power**
- **Lightweight, Flexible, Structural Integrated Solar**
- **Alternative Fuels**
- **Standardized Deployable Kits**
- **High Efficiency Systems**
- **Leveraging Local Sources**


QDR-2010
Local/Regional Resources
International Community
Political – Stability Operations
Operational Energy
Environment/ Sustainability
Capstone Concept
Force Structure
Installations/ Infrastructure
Executive Orders
Resources


Operational Energy OV-1
Energy Planning
Energy Common Operational Picture
Accountability
Visibility
Distribution
C2
Storage
Fuel efficient aircraft fly extended missions
Alternative delivery means
Site Energy Status
WED 9 JUN 10 1843 Z
85% Power
Radio Batteries
100% Power Remaining
Optics Batteries
100% Power Remaining
Water
60% of Capacity Remaining
Platform Fuel Level
85% Capacity Remaining
Alternative Fuel Capacity
25% of Capacity Requirement
OP
Wind
APOD
Host Nation Grid
Planning, monitoring, management
Water & waste management
Platform Energy Status
WED 9 JUN 10 1843 Z
85% Signal Strength
Radio Batteries
100% Power Remaining
Platform Batteries
100% Power Remaining
Longer duration sensing
Recharging while mounted
Individual power awareness
Soldiers' Energy Status
WED 9 JUN 10 1843 Z
85% Signal Strength
Radio Batteries
100% Power Remaining
Optics Batteries
100% Power Remaining
Water
60% of Capacity Remaining
SPOD
Alternative power sources
Fuel efficient vehicles operate over extended distances
Exportable power
Embedded power production, distribution, and intelligent management
Power sources reduced in size and weight
Reduced number of convoys exposed to threat
UGS provide on-the-move charging
Coalition Forces
"Energy aware" Soldiers and Leaders
Energy Visibility
Smart Grid
Energy Sharing
Army seeks improved operational performance as a direct result of reduced power and energy demand through conservation, efficiency, and deliberate management from Soldier to Theater Commander.
Operational Energy supports decentralized operations with freedom of movement, operations over extended distances, longer periods of sustained operations without resupply

OPERATIONAL ENERGY

* Generating force energy objectives are relatively mature
    - Many based upon legislation and executive orders
    - Years of experience in installation energy management
* Operational energy goal: achieve military objectives affordably/sustainably
    - Requires understanding of energy in operational capabilities & performance
    - Specific solutions change with mission(s) and situation
    - Soldier and leader behaviors drive performance – key ingredient

Initial operational energy goals focus on early success, measurement capability, planning and analysis:

- Energy efficient structures
- Fuel accountability – commanders track
- Alternative energy capabilities/use – integrated into operations - transparent
- Analysis-based plans

Smart Power Infrastructure Demonstration for Energy Reliability and Security

Cyber-security – Demonstrate defense in-depth against cyber-attack through the application of Virtual Secure Enclaves strategy to smart electric grid control

Smart Grid Technologies & Applications - Incorporate technologies into the secure micro-grid to enable automated load balancing, two-way communication, smart-metering, and automatic system re-configuration

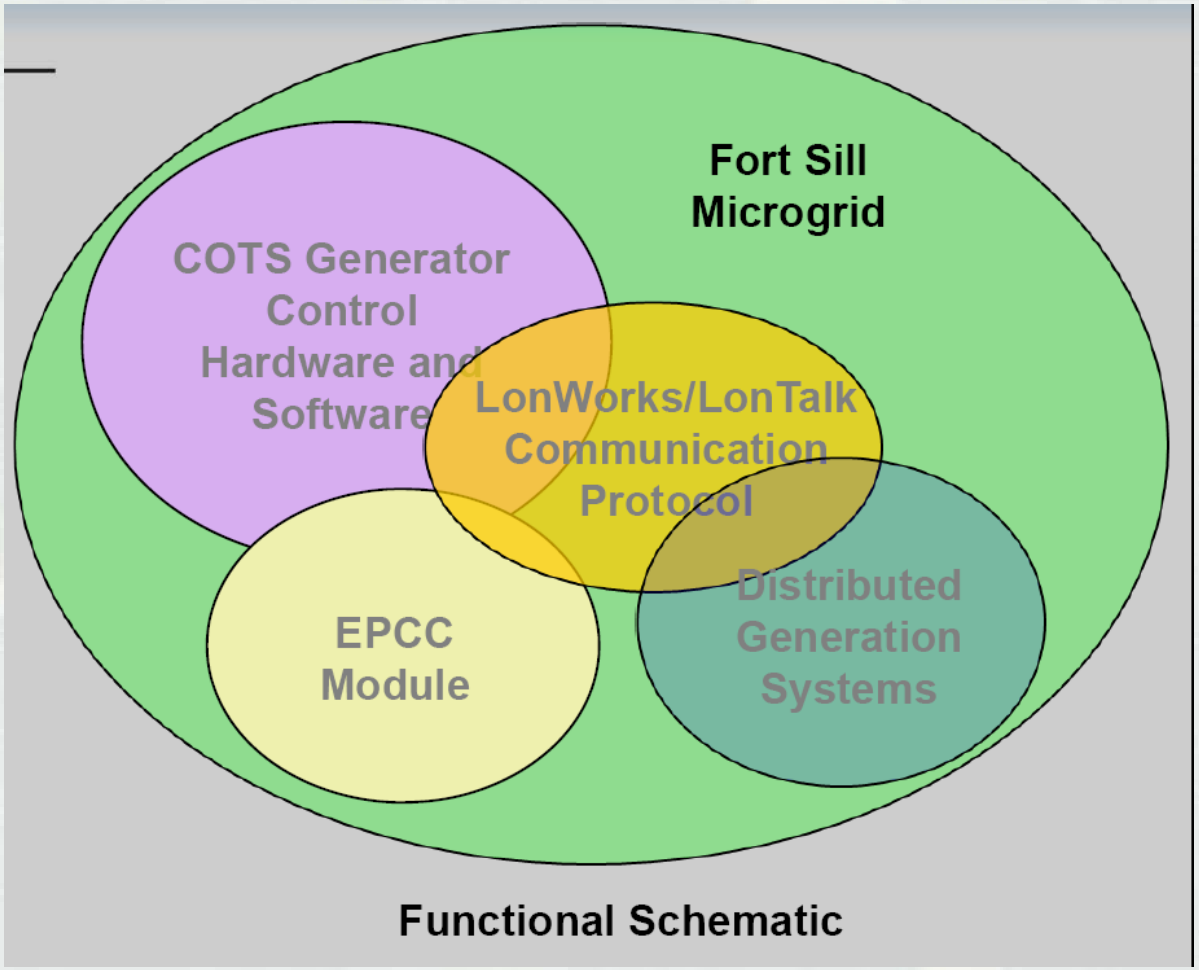
Islanded Micro-grid – Convert an entire installation to micro-grid and enable generation balancing and intentional islanding for extended continuity of operations

Integration of distributed & intermittent renewable sources – Ensure micro-grid stability through optimized use of renewable energy, storage, extend islanding operations, and reduce petroleum consumption and carbon footprint

Demand-side management – Reduce load footprint by optimizing efficiency, provide dynamic load shedding, and manage “after-event” load to maintain critical assets

Redundant back-up power systems – Ensure continuity of operations, provide an energy storage buffer for intermittent renewable energy, and enable seamless switchover from utility grid interconnection to intentional islanding

Ft. Sill Microgrid



Government demo micro-grids

Micro-Grid Title	Location	Gov't Agency	Main Contract
EPPC Beta	Ft. Irwin, CA	TARDEC	Next Energy
Power Systems & Controls (PSC)	Ft. Irwin, CA	PSTF (Power Surety Task	PSC
EPPC gamma	Detroit, MI	DLA	Next Energy
Ft. Smith, HI	Ft. Smith, HI	PACOM	
Army Corps, Ft. Sill	Ft. Sill, OK		CTC?
Air Force, Warner-Robins	Warner-Robins AFB, FL		
Hybrid Intelligent Power	Fort Belvoir, VA	PM MEP/CERDEC	N/A
Force Provide LOE1	Ft. Devins, MA	PM FSS / PM	Electricore
Electricore	Fort Belvoir, VA	PM MEP/CERDEC	Electricore
I Power	Anderson, IN	PM MEP/CERDEC	I Power
Williams-Pyro	Dallas, TX	CERDEC	Williams-Pyro
IPERC (Alternative Energy BAA)	Huntsville, AL	CERDEC	IPERC
IPERC (Energy Security BAA)		CERL	
29 Palms, CA		Marine Corps	GE
TARDEC BAA for Microgrids Topic 19	Ft. Shafter, HI	TARDEC	Honeywell
Theather Camp Energy Security		DOE/PNNL	
ExFOB	Quantico, VA	USMC	
Micro grid Test Bed		APT (SDSU)	
TARDEC BAA for Microgrids (FY11)			
Alternative Power Technology for Missile Defense		Space & Missile Defense	Radiance Technologies
BEAR Microgrid		AFRL?	Lockheed Martin
Expeditionary Power Management & Distribution		NAVFAC	
HDT Micro-grids	Federicksburg, VA	NSRDEC	Hunter Defense Technologies
Power Film Portable Miniature MicroGrids	Ames, IA	NSRDEC	Power Film

Contractor Lead micro-grids

Micro-Grid Title	Location	Main Contractor
Honeywell Microgrid	Raleigh, NC	Honeywell
Lockheed Martin Test Bed	Dallas, TX	Lockheed Martin Missiles & Fire Control
AeroJet Micro-Grid	CA? NV?	
Raytheon	McKinney, TX	Raytheon
MIT Lincoln Lab	Lexington, MA	MIT
Integrated Energy Management (IEM)	Johnson City, NY	BAE Systems
Autonomic Logistic Prototype		Penn State ARL
TDI 30 kW Turbogen (AP-30)	Ortonville, MI	Technical Directions, Inc
Simplified Paralleling of Small Turbogenerators		awards est. ~Oct 2010

Questions?