



DoD Installations, Energy and the Environment: An Update

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Installations & Environment

E^2S^2 Symposium

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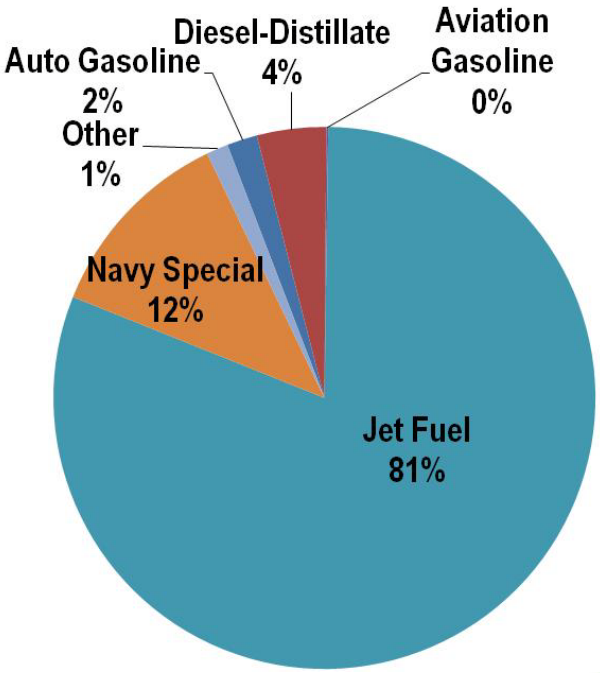
I. Why Facilities Energy Matters

II. Facilities Energy Core Strategy

III. Key Role of Technological Innovation

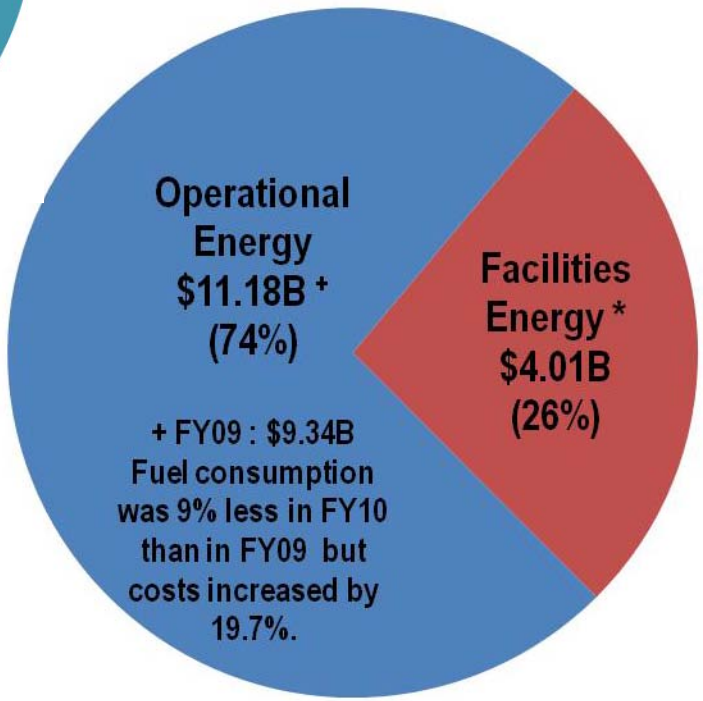
IV. Other I&E Priorities

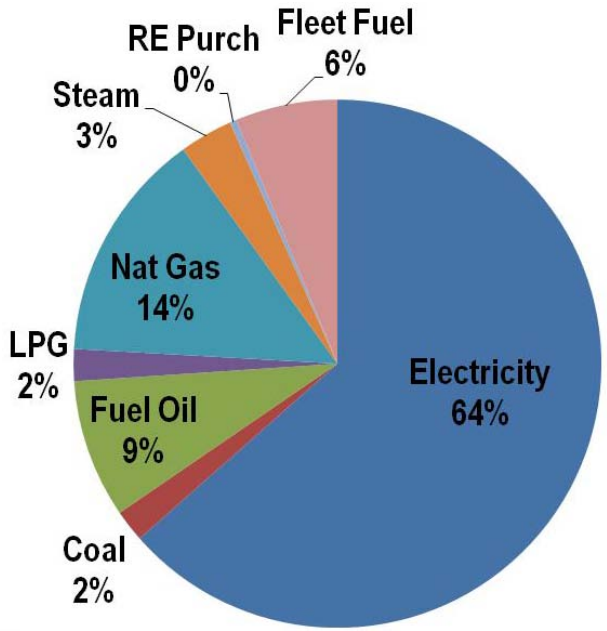
DoD Energy Costs, FY2010



Operational

DoD Energy Costs
FY10: $15.2B
FY09: $13.4B



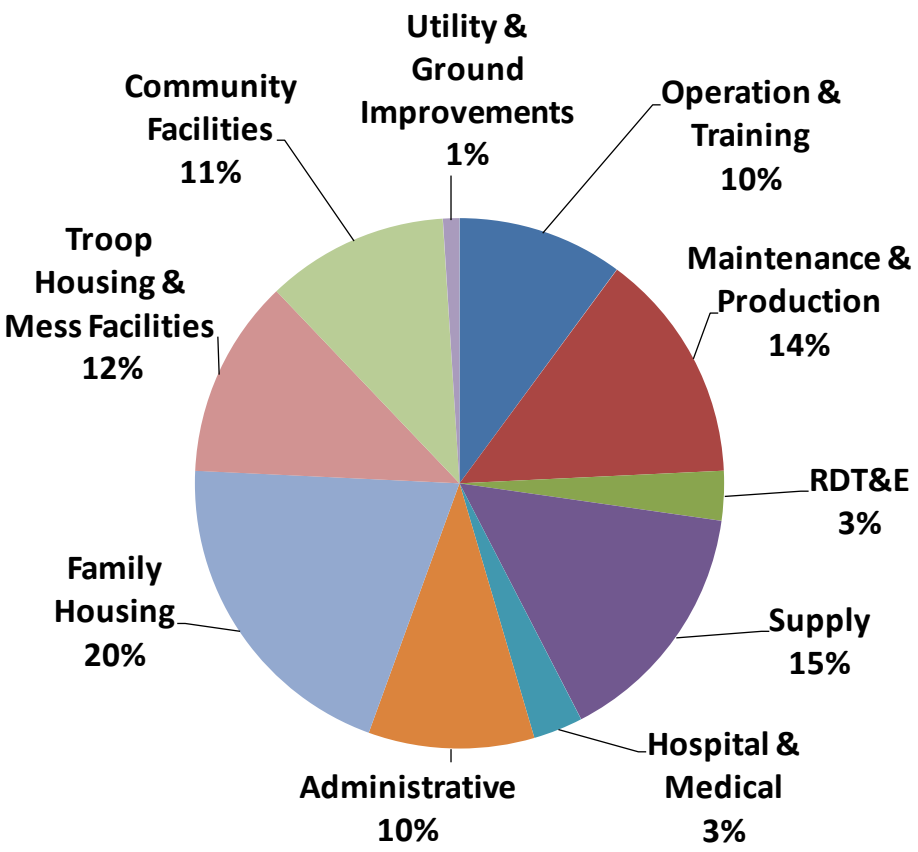


Installations

* $4.01B in facilities energy costs include non-tactical vehicle fuel
$3.76B – facilities energy
$0.25B – non-tactical vehicle fuel

DoD Built Infrastructure

- 539,000 Facilities (buildings and structures)
  - 307,295 buildings
    - 2.2 billion square feet
- Comparisons
  - GSA: 1,500 government buildings
    - 176 million square feet
  - Wal-Mart US: 4,200 buildings
    - 687 million square feet
- 160,000 Fleet Vehicles

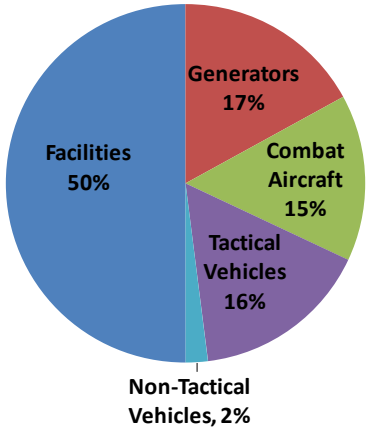


Why Facilities Energy Matters

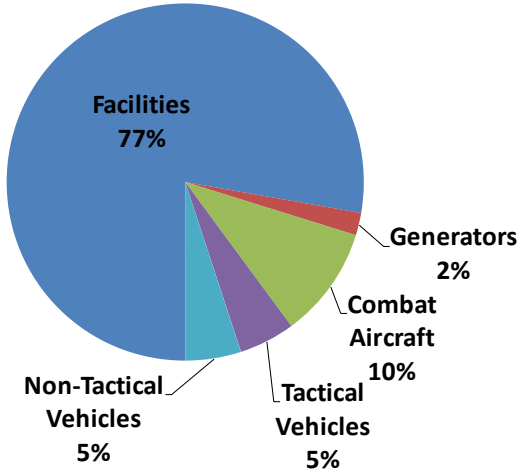
- Significant Cost
  - FY10: $4.0 billion (26% of total DoD energy costs)
  - Cost likely to increase (reduced presence in Iraq and Afghanistan, improved QoL)
- Environmental Impact
  - Contributes a disproportion share (~ 40%) of GHGs
- Mission Assurance/Energy Security
  - DoD's reliance on a fragile commercial electricity grid places continuity of critical missions at serious and growing risk [1]

[1] Defense Science Board, "More Fight – Less Fuel," February 2008

Army CO_2 Emissions Today

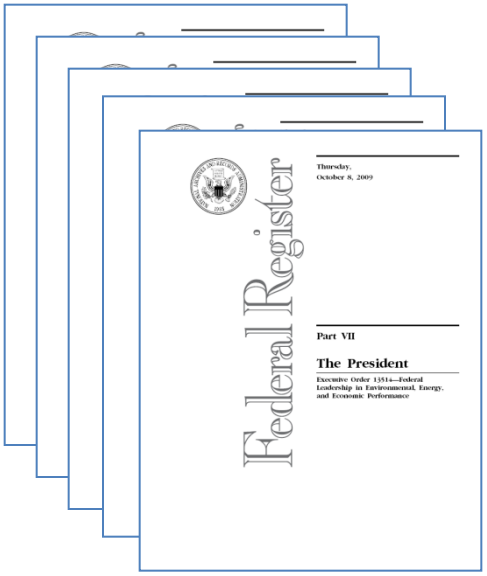


Army CO_2 Emissions Future?



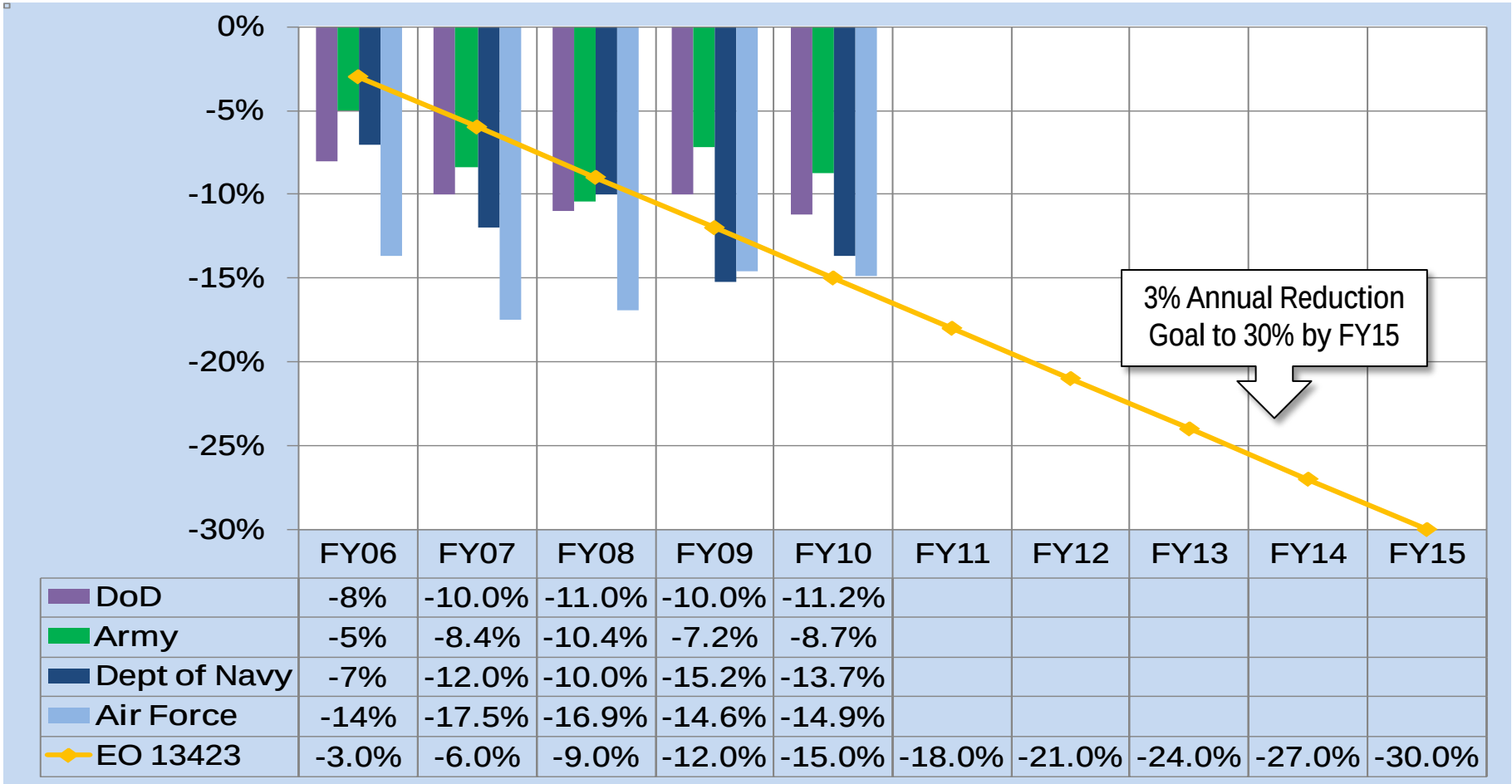
Key Energy Goals

- Legislation and Executive Orders
  - EPAct 2005, EISA 2007, NDAA
  - EO 13423, EO 13514
- Key Targets
  - Facility Energy Efficiency
    - Reduce facilities energy intensity by 30% by 2015 and 37.5% by 2020 (2003 baseline)
  - Renewable Energy
    - Consume 7.5% of electric energy from renewable resources by 2013
    - Produce or procure 25% of facilities energy from renewable sources by 2025
  - Water
    - Reduce potable water intensity by 26% from a 2007 baseline by 2020.
    - Reduce non-potable water consumption by 20% by 2020 from a 2010 baseline



DoD Progress Towards EISA2007 Sec. 431 Facilities Energy Intensity Reduction Goal

Acquisition, Technology and Logistics

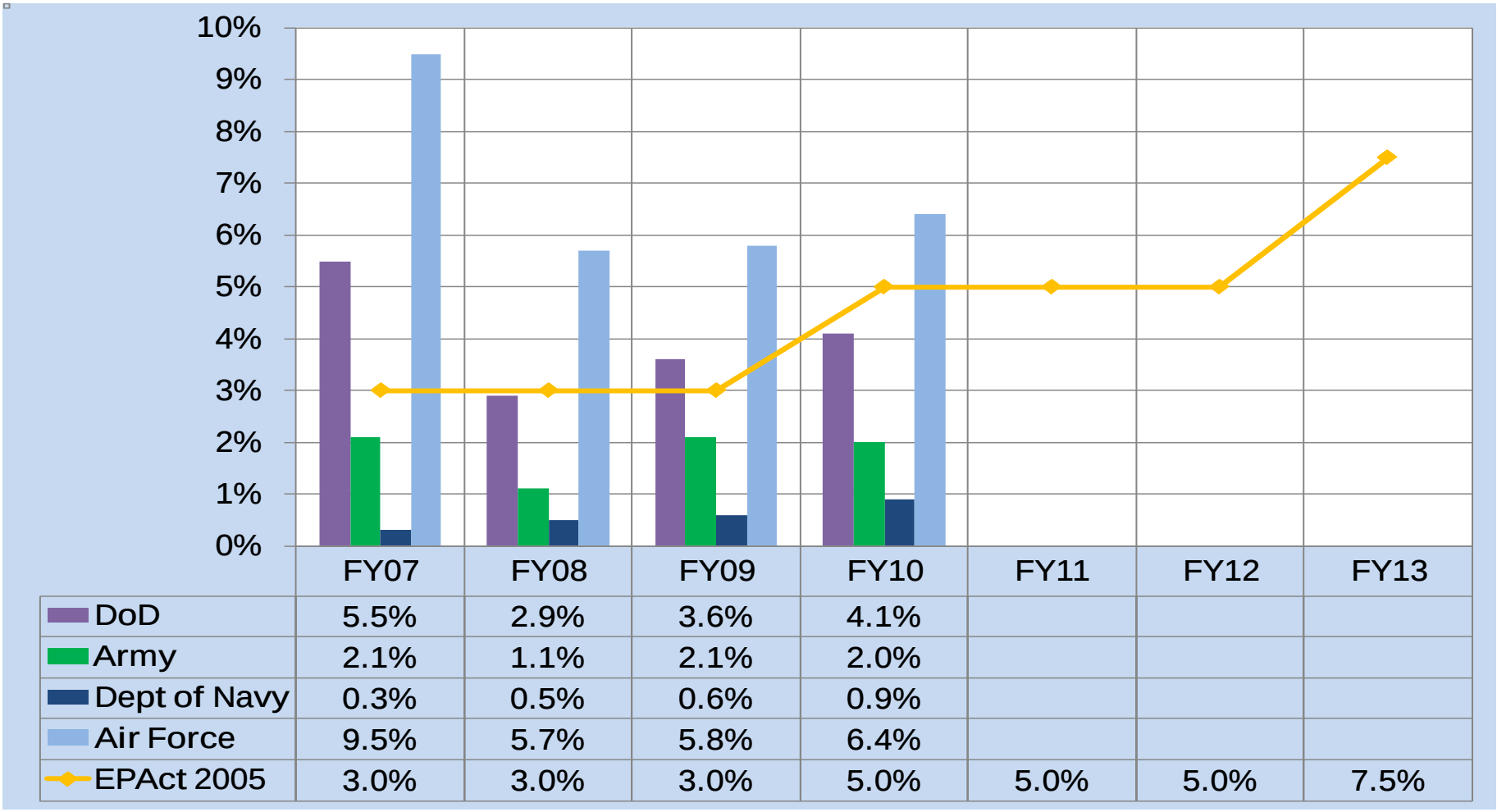


	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15
DoD	-8%	-10.0%	-11.0%	-10.0%	-11.2%					
Army	-5%	-8.4%	-10.4%	-7.2%	-8.7%					
Dept of Navy	-7%	-12.0%	-10.0%	-15.2%	-13.7%					
Air Force	-14%	-17.5%	-16.9%	-14.6%	-14.9%					
EO 13423	-3.0%	-6.0%	-9.0%	-12.0%	-15.0%	-18.0%	-21.0%	-24.0%	-27.0%	-30.0%

Reduce facilities energy intensity by 30% by 2015 and 37.5% by 2020 (2003 baseline).

DoD Progress Towards EPAct 2005 Sec 203 Renewable Energy Goal

Acquisition, Technology and Logistics

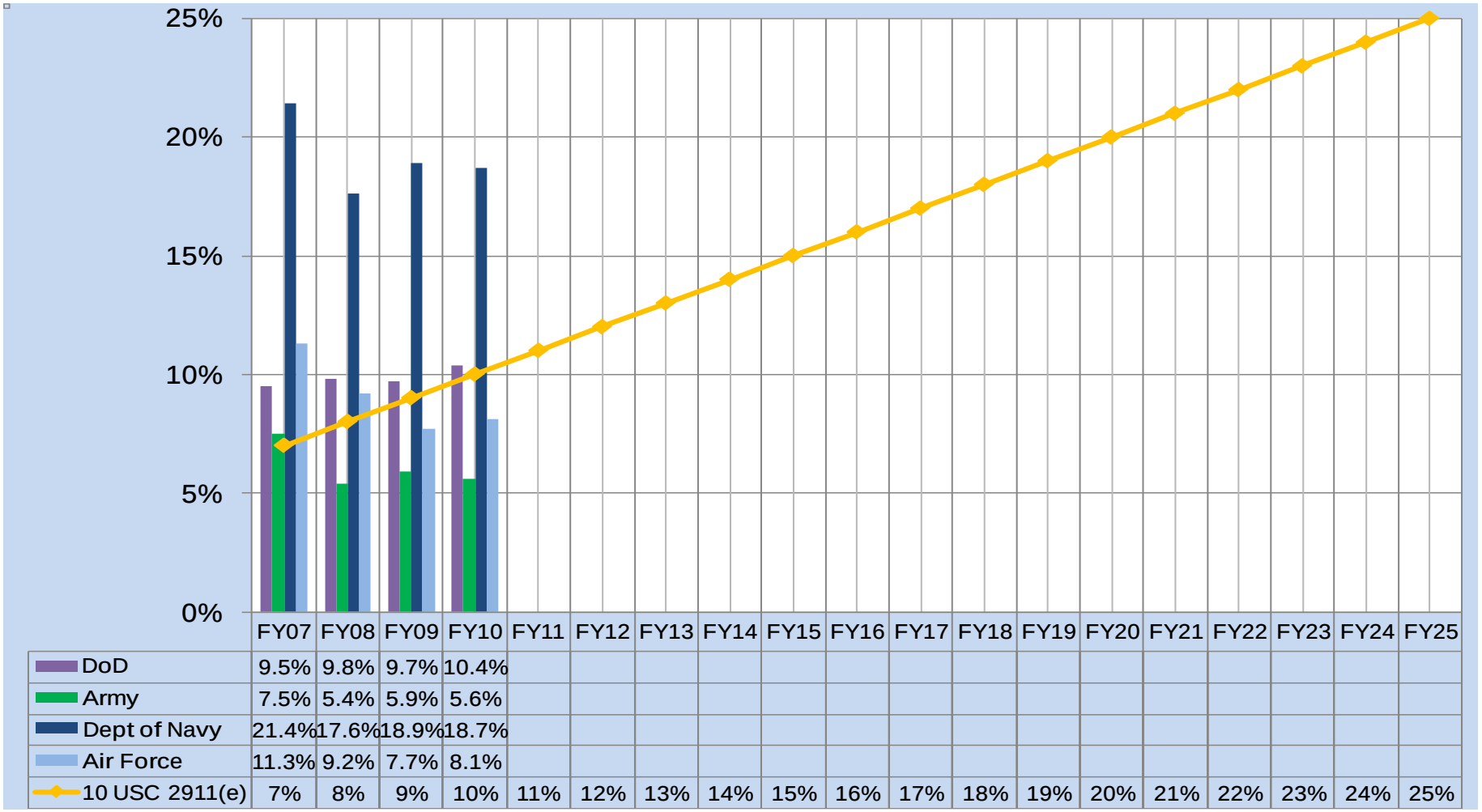


	FY07	FY08	FY09	FY10	FY11	FY12	FY13
DoD	5.5%	2.9%	3.6%	4.1%			
Army	2.1%	1.1%	2.1%	2.0%			
Dept of Navy	0.3%	0.5%	0.6%	0.9%			
Air Force	9.5%	5.7%	5.8%	6.4%			
EPAct 2005	3.0%	3.0%	3.0%	5.0%	5.0%	5.0%	7.5%

Consume 7.5% of electric energy from renewable resources by 2013.

DoD Progress Towards 10 USC 2911(e) Renewable Energy Goal

Acquisition, Technology and Logistics

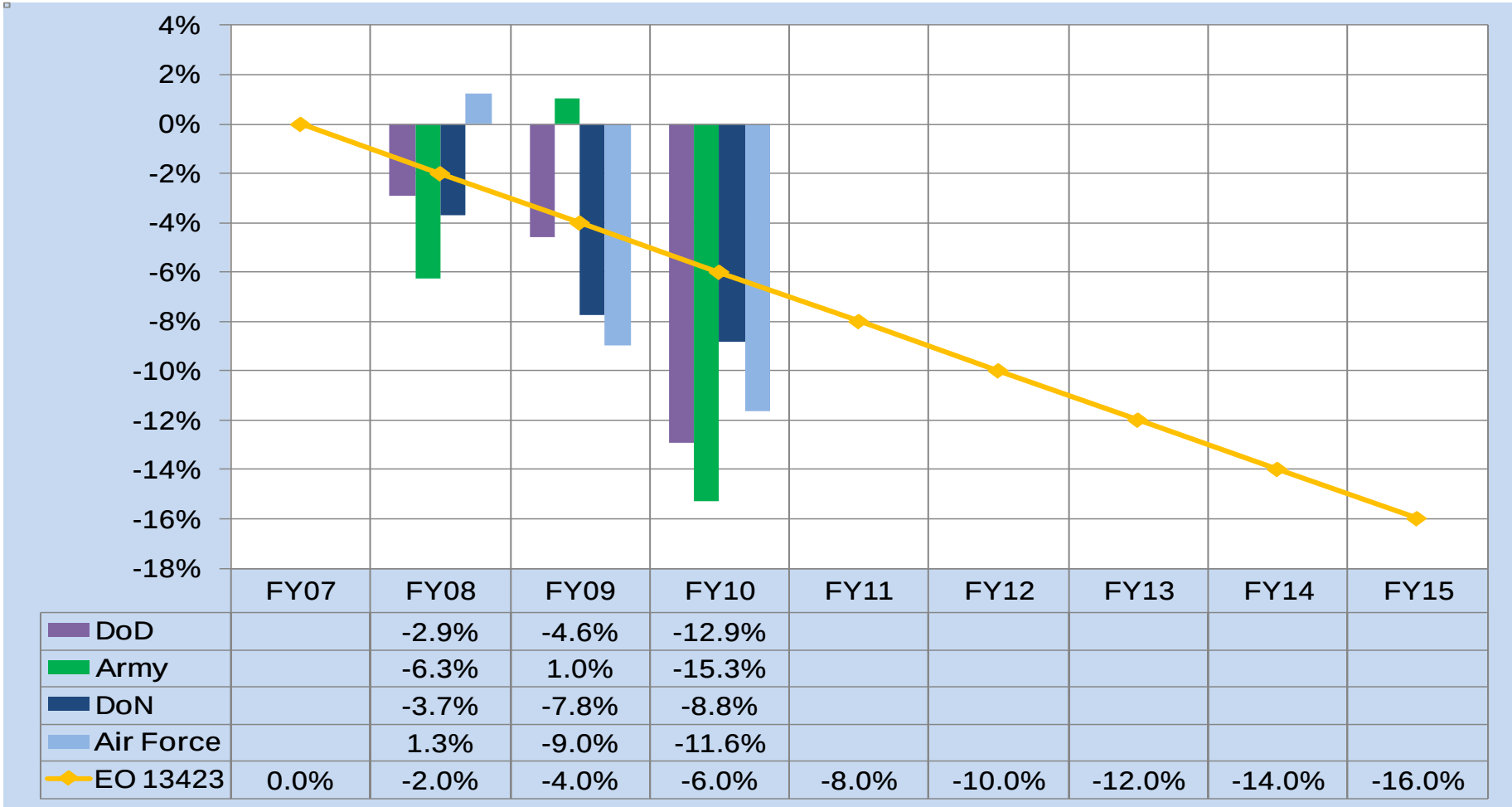


	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25
DoD	9.5%	9.8%	9.7%	10.4%															
Army	7.5%	5.4%	5.9%	5.6%															
Dept of Navy	21.4%	17.6%	18.9%	18.7%															
Air Force	11.3%	9.2%	7.7%	8.1%															
10 USC 2911(e)	7%	8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%	21%	22%	23%	24%	25%

Produce or procure 25% of electricity consumed from renewable sources by 2025.

DoD Progress Towards EO 13423 Water Intensity Goal

Acquisition, Technology and Logistics



	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15
DoD		-2.9%	-4.6%	-12.9%					
Army		-6.3%	1.0%	-15.3%					
DoN		-3.7%	-7.8%	-8.8%					
Air Force		1.3%	-9.0%	-11.6%					
EO 13423	0.0%	-2.0%	-4.0%	-6.0%	-8.0%	-10.0%	-12.0%	-14.0%	-16.0%

Reduce potable water intensity by 26% from a 2007 baseline by 2020.

I. Why Facilities Energy Matters

II. Facilities Energy Core Strategy

III. Key Role of Technological Innovation

IV. Other I&E Priorities

Facilities Energy Core Strategy

- ***Reduce Demand*** **– energy efficiency/conservation**
  - Use SRM budget ($8.8B) to retrofit existing buildings
  - Use MilCon budget ($14.8B) to improve new construction
    - LEED Silver (40% of points from energy and water)
    - 30% above ASHRAE standards
  - Private financing (ESPCs) also key
- ***Increase Supply*** **of renewable/alternative energy**
  - Large military installations well suited to support solar, wind and geothermal, but T&E species a challenge
  - Potential for rooftop renewable on large scale
  - Private financing essential
- ***Improve Energy Security*** **– focus on grid disruption**
  - Risk mitigation plans
  - Micro-grid demonstrations
  - Net Zero Energy Installation initiatives

Facilities Energy Program Review

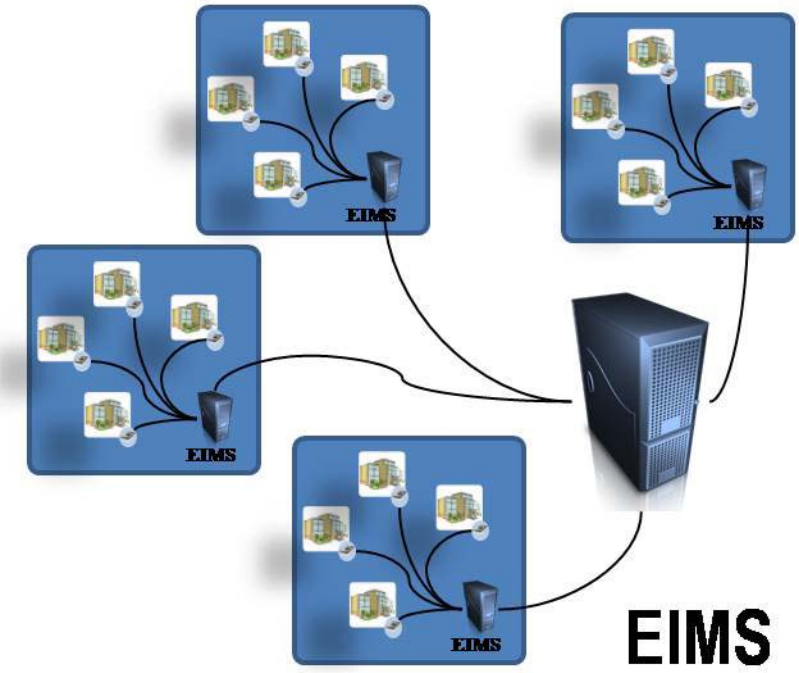
- Facilities energy budget not well defined
  - MilCon and FSRM represent the majority of expenditures that reduce facility energy consumption, but energy specific investments not separated.
  - ECIP: Only dedicated funding line for energy investments, <10% of total investments required to meet mandates.
- FY12 POM Review
  - Attempted to identify non-ECIP energy investments funded by MilCon and FSRM
  - Determined need for a facilities energy budget exhibit to identify requirements and program shortfalls to meet energy targets
- I&E working Comptroller and CAPE to develop budget exhibit
  - Add to Financial Management Regulation requirement for Services to submit facilities energy budget exhibit with Pres Bud
  - Budget exhibit will identify requirements to meet energy mandates and how much Services are programming across the FYDP

Energy Conservation Investment Program

- Small but key component of the Department's strategy. ECIP projects historically obtained better than two dollars in life-cycle savings for every dollar invested.
- Funding: FY09--$210M, FY10--$174M, FY11--$120M (?), FY12--$135M request
- Project selection: Beginning in FY12, ECIP will move away from routine energy efficiency and renewable projects, which can be accomplished with O&M funds, to projects that will produce "game changing" energy efficiency improvements:
  - Integrate distributed generation & storage to improve supply resiliency for critical loads
  - Implement energy security plans, especially at those installations where such investments leverage partnerships with the Department of Energy
  - Dramatically change the energy consumption at individual installations (e.g power and steam plant level investment)
  - Integrate multiple energy savings, monitoring, and renewable energy technologies to demonstrate synergistic benefits
  - Implement technologies validated in DoD's Installation Energy Test Bed Initiative or other DoD/DoE sponsored demonstration programs

Enterprise Energy Information Management

- DoD Enterprise Energy Information Management System
  - New OSD initiative to provide an enterprise-wide capability to effectively monitor, measure, manage and maintain energy systems at optimal performance level
  - Will enable more informed facilities energy investment and management decisions



OSD Energy Management System Concept

Utility Consumption
(Elec/Water/Gas/Oil)

Utility Purchasing

Consumption and costs aggregated by supply, usage, customer, facility, installation, Command, Component, conditions

Reporting/Dashboard

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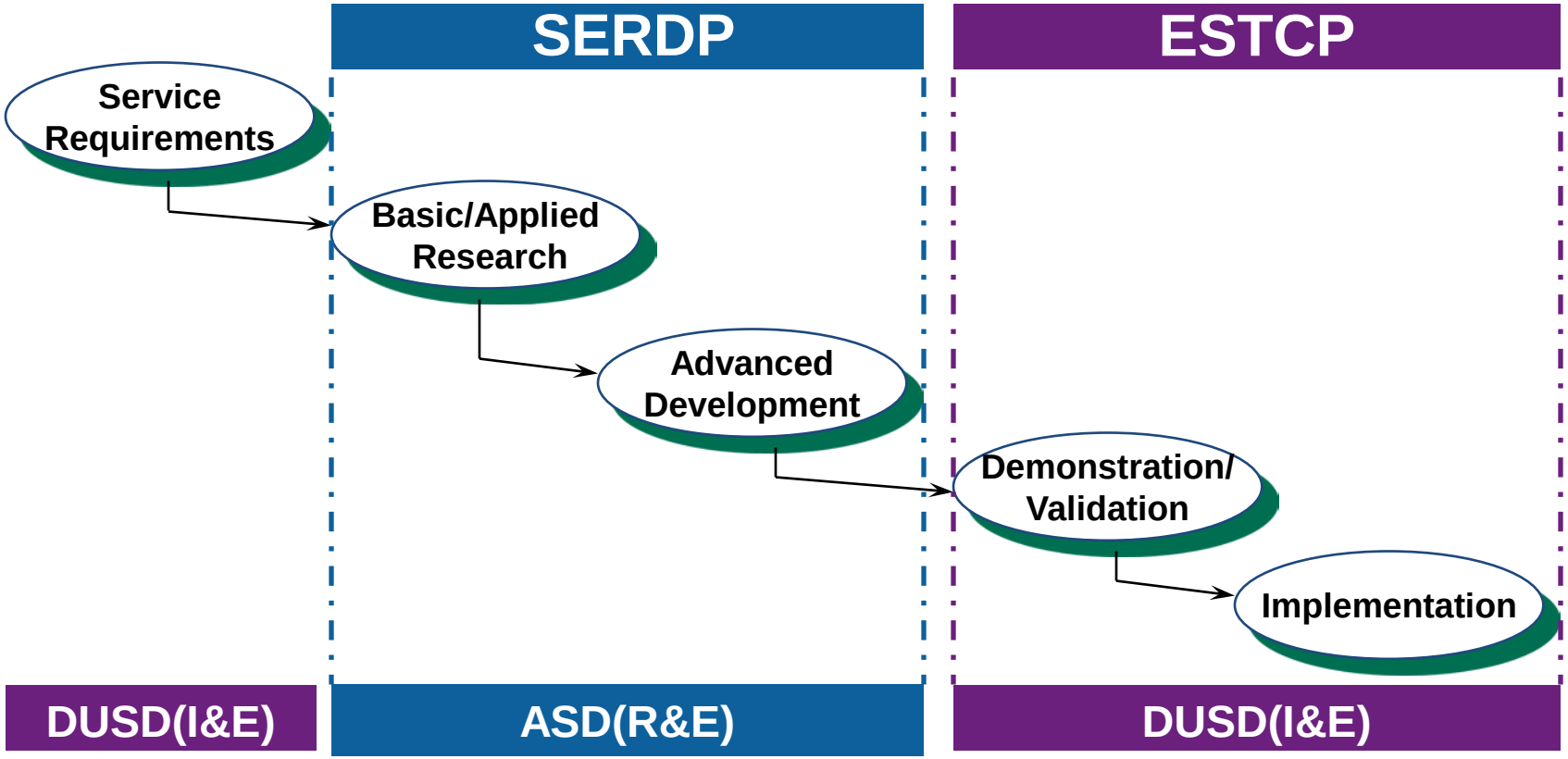
Technology Development Process

Acquisition, Technology and Logistics

SERDP DOD • EPA • DOE — Science and Technology

ESTCP — Demonstration/Validation



A Requirements Driven Integrated Program

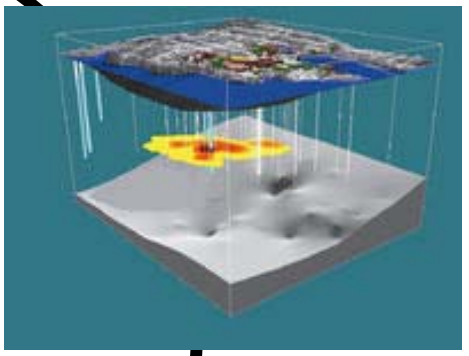
ESTCP Focus Areas

Acquisition, Technology and Logistics

Weapons Systems & Platforms

Energy & Water

Environmental Restoration



Resource Conservation & Climate Change

Munitions Response

ESTCP Installation Energy Test Bed

- Emerging technologies hold the promise of dramatic improvements in building energy performance but face major impediments to commercialization and deployment
  - A&E firms face liabilities but do not share in savings
  - Disincentives for ESCOs
  - No incentive for first use
  - Highly cost-sensitive market
  - Lack of operational testing deters potential adopters
- DoD's Test Bed Initiative is designed to overcome these barriers
- DoD is uniquely positioned to play this role
  - It is in DoD's self interest given the size of our inventory (Wal-Mart has its own energy test bed but it is limited to big-box stores)
  - DoD's built infrastructure is unique for its size and variety— it captures the diversity of building types and climates in U.S.
  - Military has 150 years of experience as a sophisticated first user of new technology and an early, market-creating customer (jet engines, aircraft, integrated circuits, GPS, internet)

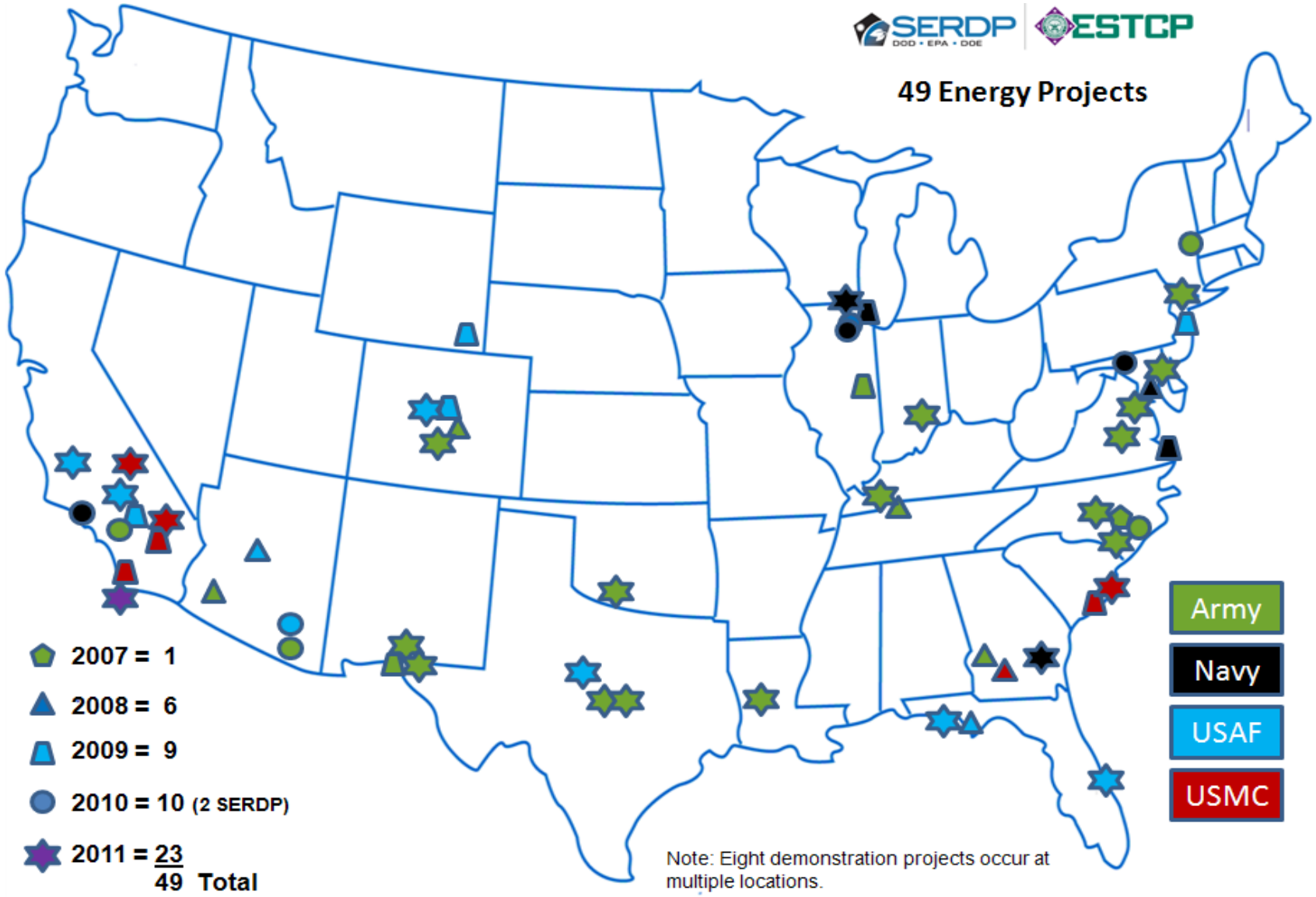
FY 2012 Solicitation

Installation Energy Solicitation Released on February 1, 2011

1. Smart Micro-grids and Energy Storage to Increase Energy Security on DoD Installations
2. Renewable Energy Generation on DoD Installations
3. Advanced Component Technologies to Improve Building Energy Efficiency
4. Advanced Building Energy Management and Control
5. Tools and Processes for Design, Assessment and Decision-making Associated with Energy Use and Management

Installation Energy Test Bed Project Locations

Acquisition, Technology and Logistics



BIPV Roofs

DESCRIPTION

- Validate whether BIPV roofs can endure weather conditions as well as conventional roofs
  - Luke AFB, MCAS Yuma, NAS Patuxent
- Verify whether a roof integrated solar photovoltaic system can perform as a cost effective energy efficient roof
- Promote adoption of BIPV roof technology within DoD through the Unified Facilities Guide Specification (UFGS)

BENEFITS/METRICS

- Demonstrations will document energy savings, costs, reliability and applicability to DoD roofs
- Effectively low cost per Watt installed

PERFORMERS

- NAVFAC ESC
- Lawrence Berkeley National Laboratory
- ERDC- CERL
- SEI Group, Inc

Continuous Building Commissioning

Acquisition, Technology and Logistics

DESCRIPTION

Objectives are to demonstrate whole-building modeling and monitoring systems capable of:

1) identifying, classifying, and quantifying energy and water consumption deviations from design intent or optimal,
2) identifying the causes of those deviations, and
3) recommending, prioritizing, and implementing corrective actions

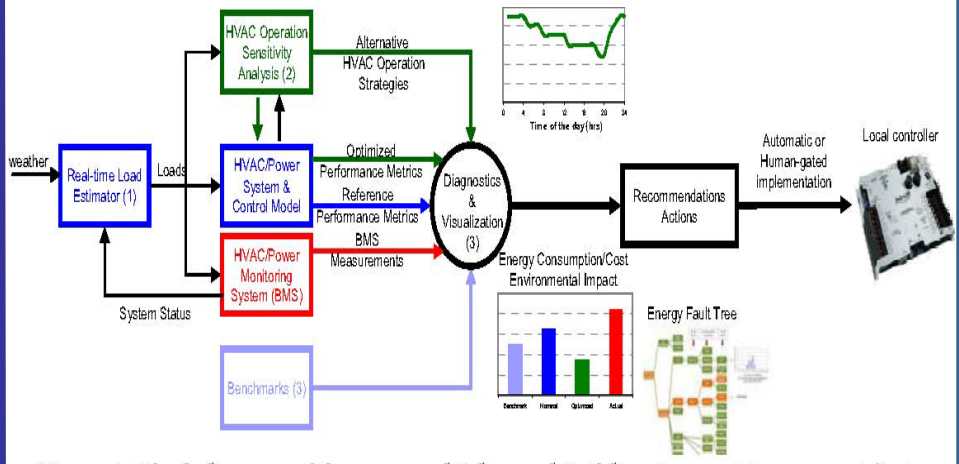


Figure 1. Block diagram of the proposed Advanced Building Energy Management Systems

BENEFITS/METRICS

- Demonstrations will document energy savings, costs, reliability and applicability to DoD buildings.
- Successful implementation of this technology will enable reduced energy consumption, peak electric demand, and water use in DoD buildings by providing actionable information to facility managers and building operators.

PERFORMERS

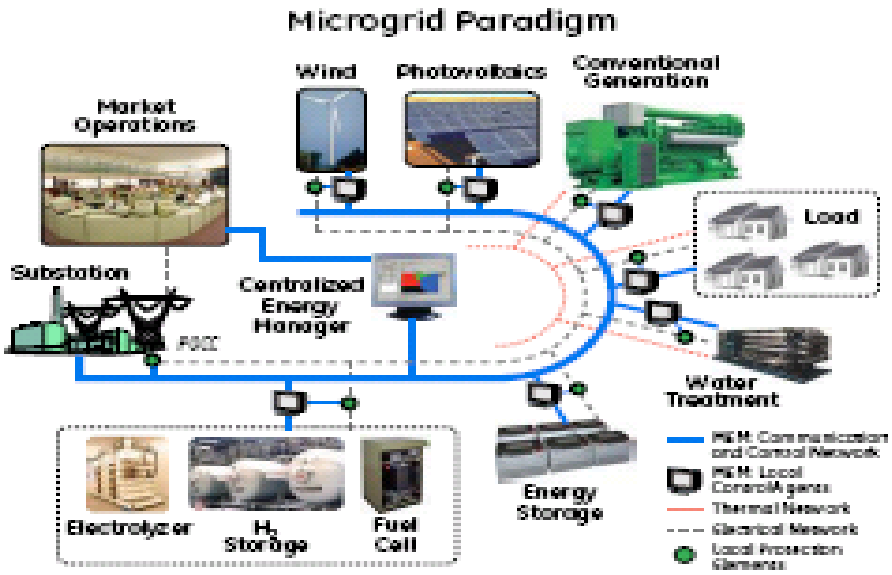
- United Technologies Research Center
  - Lawrence Berkeley National Laboratory
  - University of California, Berkeley
- Multiple Projects
  - Model based performance of single buildings
  - Scalability through reduced order models
  - Campus scale

Smart Microgrids

Acquisition, Technology and Logistics

DESCRIPTION

- Enhance and demonstrate an advanced micro grid technology for DoD installations
  - Microgrid design
  - Optimal dispatch
  - Load shedding
  - Intentional islanding
  - Energy management
- Demonstrations at 29 Palms and Ft. Bliss



BENEFITS/METRICS

- Allow secure islanding of DoD installation and reduce costs of electricity
- Increase use renewables, energy efficiency and improve power quality

PERFORMERS

- GE Global Research
  - 29 Palms
- Lockheed Martin
  - Ft. Bliss
- FY 2012 BAA
  - TBD

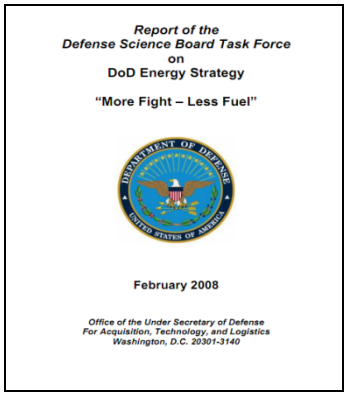
DOE-DOD Energy Security MOU

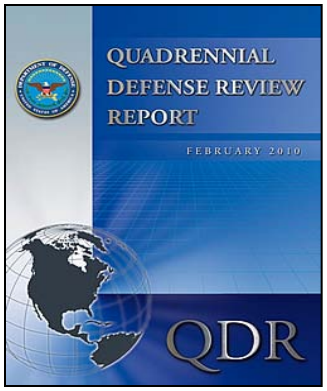
Acquisition, Technology and Logistics

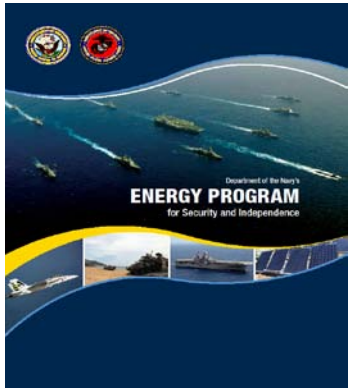
"Concerning Cooperation in a Strategic Partnership to Enhance Energy Security"

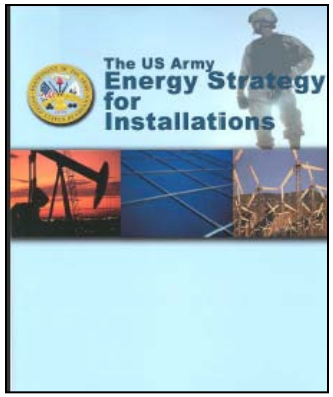
The Purpose:

- Identify a framework for cooperation and partnership between the Department of Energy (DOE) and the Department of Defense (DOD)
- Strengthen coordination of efforts to enhance national energy security, and demonstrate Federal Government leadership in transitioning America to a low carbon economy









DOE-DOD Executive Leadership

Acquisition, Technology and Logistics

Executive Committee Co-Chairs

- Patricia Hoffman, Office of Electricity Delivery and Energy Reliability, DOE
- Sharon Burke, Assistant Secretary, Operational Energy, DOD
- Dorothy Robyn, Deputy Under Secretary, Installations and Environment

DOE

- Electricity Delivery and Energy Reliability (OE)
- Office of the Deputy Secretary
- Energy Efficiency and Renewable Energy (EERE)
- Advanced Research Project Agency-Energy (ARPA-E)
- Nuclear Energy (NE)
- Fossil Energy (FE)
- Office of Science (SC)

DOD

- Operational Energy Plans and Programs
- Installations and Environment (I&E)
- Army
- Navy
- Air Force
- Research and Engineering (DDR&E)
- Joint Staff (J4)

Advisory Group Priority Areas

- Mobility and Strike Capability
  - Vehicles
  - Biofuels
  - Storage
- Energy Reliability and Efficiency on DOD Bases
  - Smart grids/Microgrids/Power Management
  - Storage
  - Soldier Systems
  - Small Modular Reactors
  - Siting Renewables
  - Building Efficiency
  - Energy Parks/Asset Revitalization
- Institutional Cooperation
  - COCOM Energy Advisors
  - Professional Military Education
  - DOE-DOD MOU Catalog

Efficiency and Reliability: Grid Storage at DOD Installations

Acquisition, Technology and Logistics

Voltage Ride-through
Stability During Pulsed Power Requirements for Radar, etc.

Continuity of Operations
Short-term and Long-Term Blackout Contingency Capacity

Black-Start Capability
Post-Blackout Restart Capability

Energy Savings
Reduced Fuel Costs, Reduced Demand Charges/Energy Charges

- **Goal:** Develop Profile of Capacity / Duration / Reliability and Cost for Energy Storage at DoD CONUS facilities
- **Target:** Approximately Five DoD Relevant Uses of Energy Storage
- **Outcome:** Address 'Serial #1' Problem for Adoption of New Storage Technologies on Grid
- **Team:** Leverage EPRI's expertise of grid storage applications, ARPA-E's technology knowledge, and ESTCP's understanding of facilities

ESTCP SERDP DOD · EPA · DOE arpa·e EPRI ELECTRIC POWER RESEARCH INSTITUTE

I. Why Facilities Energy Matters

II. Facilities Energy Core Strategy

III. Key Role of Technological Innovation

IV. Other I&E Priorities

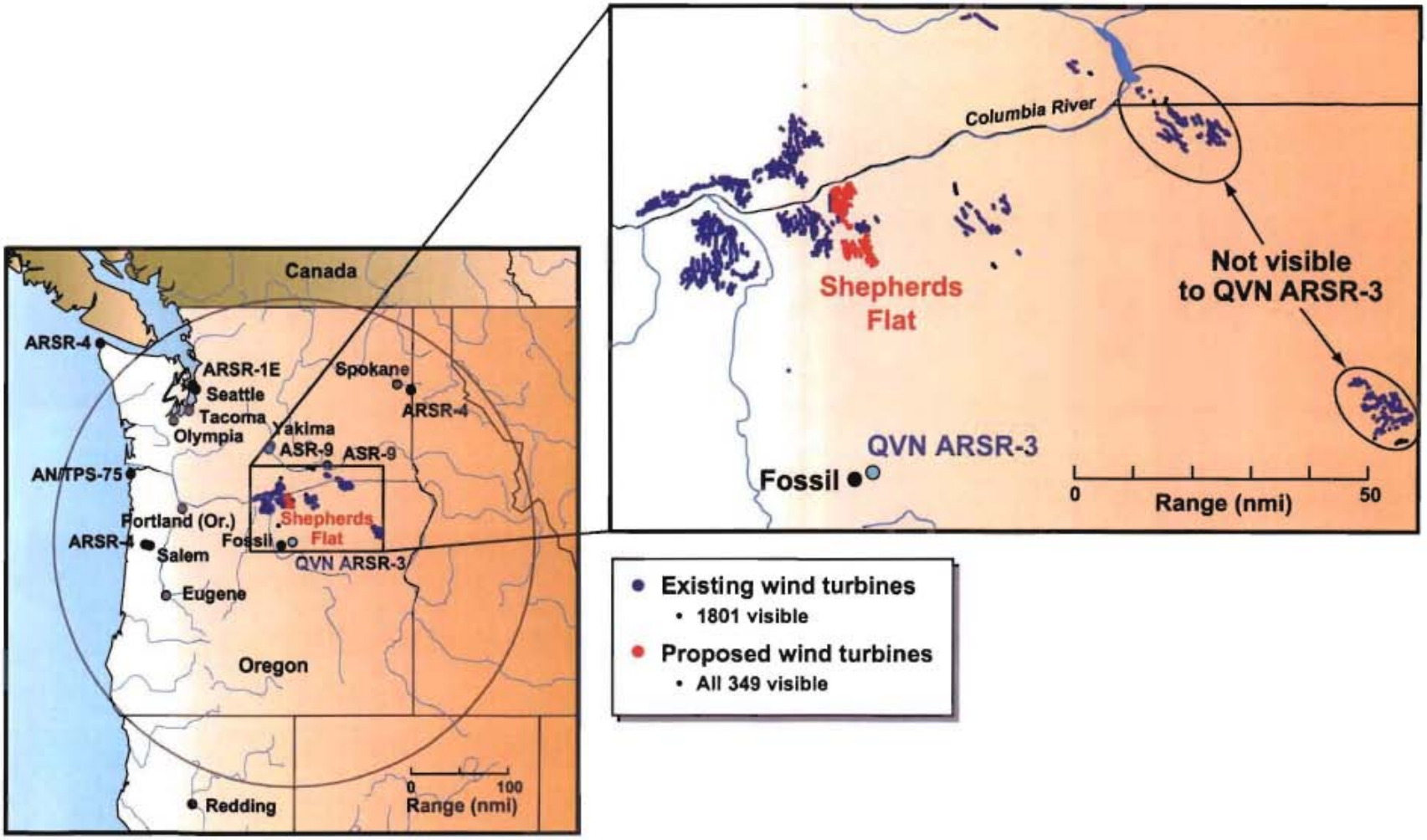
Renewable Energy Siting Challenges

- Turbines and solar towers can interfere with military radar and flights

- Problem arises in 3 contexts
  - Surveillance
  - Weapon system testing
  - Operations & training

- DoD weighs in late in process because of nature of the FAA review process

Shepherd's Flat – We Were Unprepared



Renewable Energy Siting – Way Forward

- Energy Siting Clearinghouse
- R&D to better model impact and mitigate potential adverse effects
- Accelerate upgrades to and replacement of surveillance radars

DoD Energy Siting Clearinghouse

- A Single DoD Voice
  - Timely, repeatable, and predictable process that promotes compatibility between energy independence and military capabilities: two key facets of national security
  - Most projects will be reviewed and cleared by Services in 30 – 45 days
  - Only projects with significant impacts or that need multi-Service coordination will receive full Clearinghouse attention

Dave Belote
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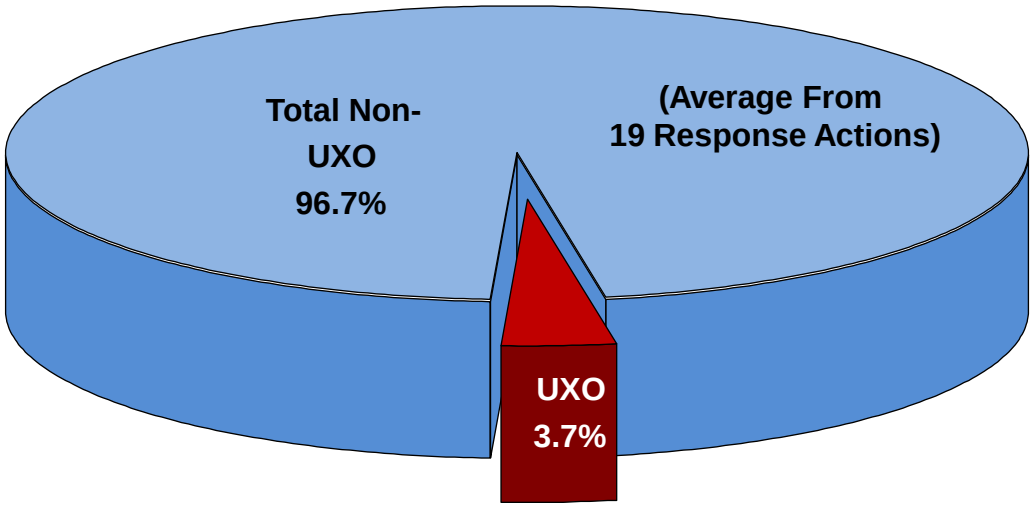
UXO Cleanup Dilemma

- Less than 4% of excavations are UXO
  - Usually <1%
  - Ex. Camp Butner
    - 7 items out of > 100,000 digs
- Most items are harmless scrap
- Excavation of suspected UXO drives cost and time

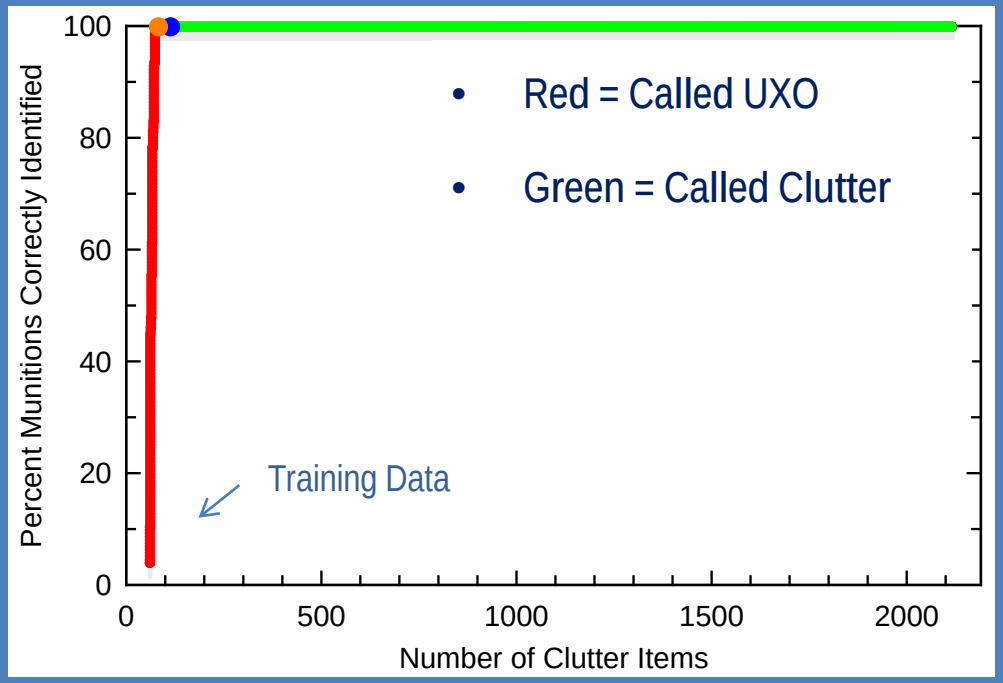


New Technology Enables Discrimination

- SERDP/ ESTCP have been investing in this area for 10 years
- Result is technology that can distinguish UXO from clutter with high degree of reliability

Advanced Sensor at former Camp Butner, NC

- Near-Perfect Results are Achievable on a Real UXO Site
  - 100% of munitions correctly called UXO
  - Over 2000 correctly called clutter out of about 2100 total
  - Eliminate ~95% of clutter with no missed UXO

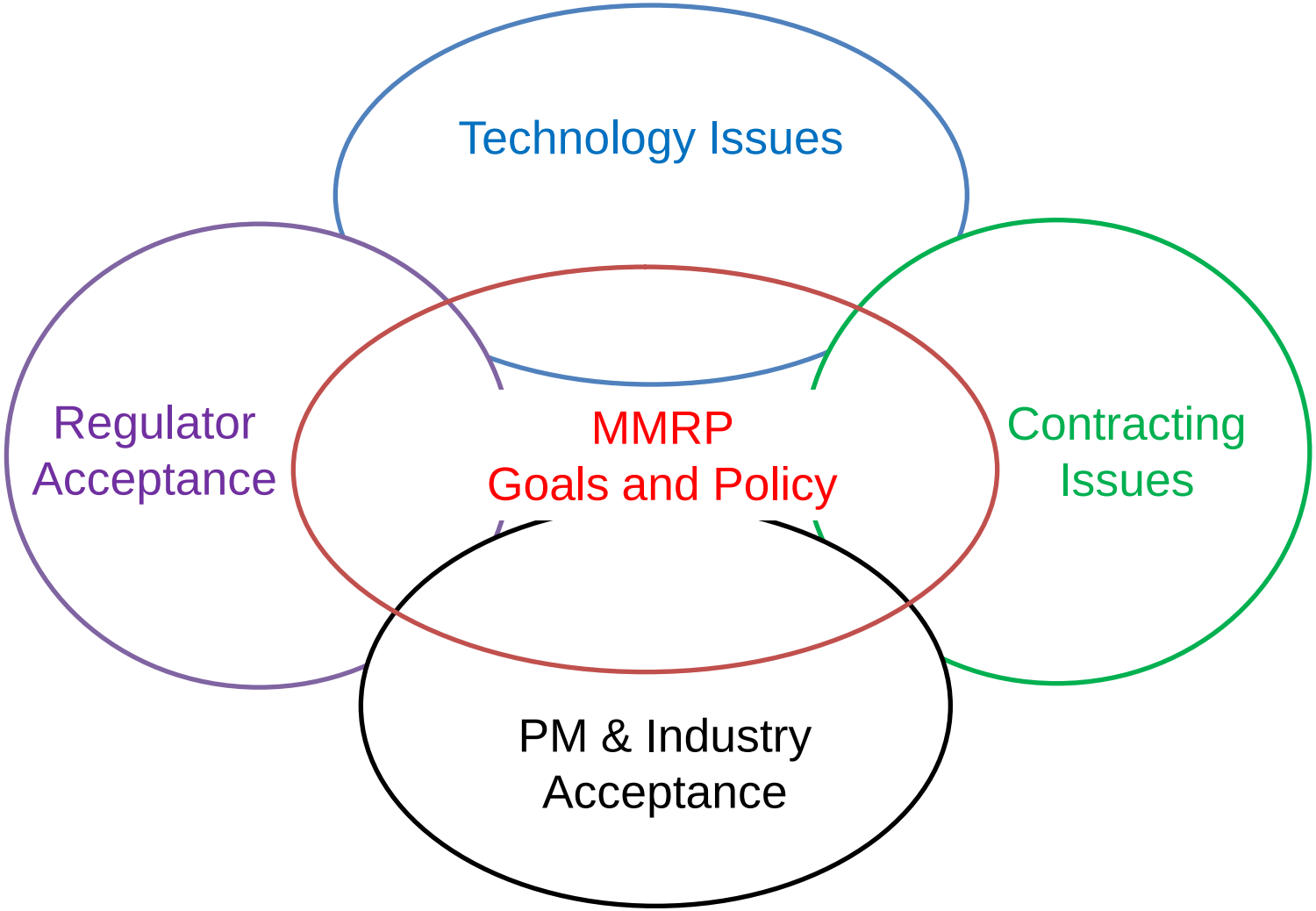


ESTCP Live Site Demonstration Program

- Demonstrations on real munitions response sites completed at:
  - Camp Sibert, AL
  - Camp San Luis Obispo, CA
  - Camp Butner, NC

- Demonstrations are ongoing at:
  - Mare Island Naval Shipyard, CA
  - Pole Mountain, WY
  - Camp Beale, CA

- Five additional demonstrations are planned


Technology Issues
Regulator Acceptance
MMRP Goals and Policy
Contracting Issues
PM & Industry Acceptance