



DoD, Energy Security and Technological Innovation

Dorothy Robyn
Deputy Under Secretary of Defense
(Installations & Environment)

SunShot Grand Challenge
Summit and Technology Forum
June 13, 2012







Key Points

- DoD's effort to reduce its high level of facility energy consumption is driven by mission considerations— cost and energy security.
- Renewable energy— combined with advanced microgrid and storage technologies— can significantly improve the energy security of our military installations.
- As a technology leader, DoD can play an important role in our country's clean energy revolution by pursuing its own strategic goals and self-interest.

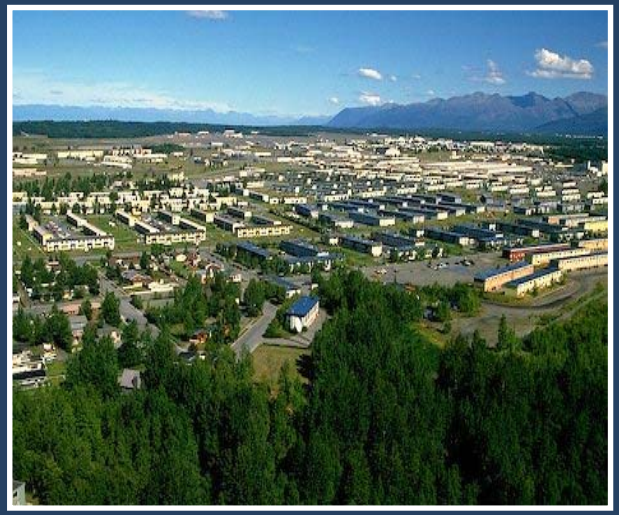
DoD's Built Infrastructure

Acquisition, Technology and Logistics

298,897 buildings

2.3 billion square feet

160,000 Fleet Vehicles



DoD's Natural Environment

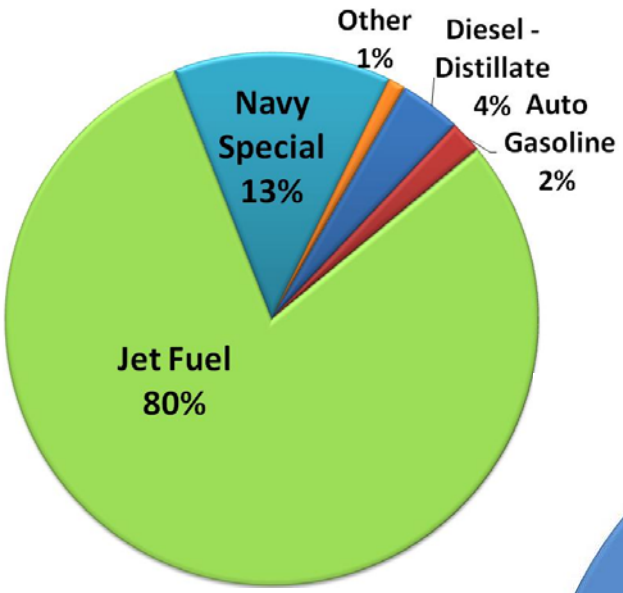
Acquisition, Technology and Logistics

29 million acres

420 endangered species

Broad diversity of ecosystems

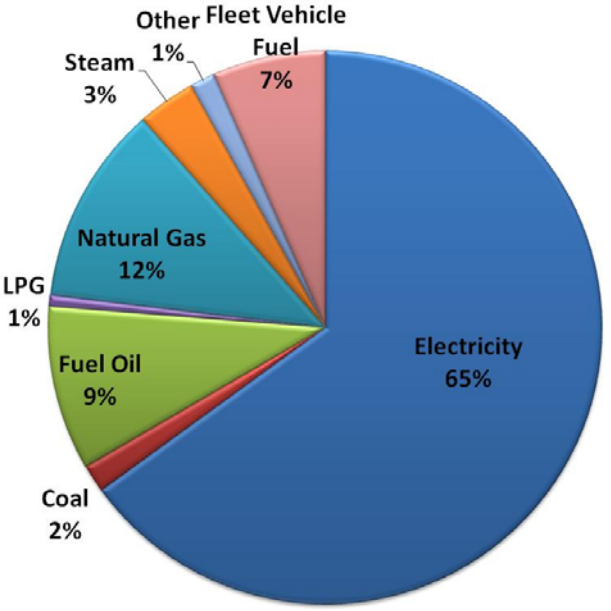
DoD Energy Costs, FY2011

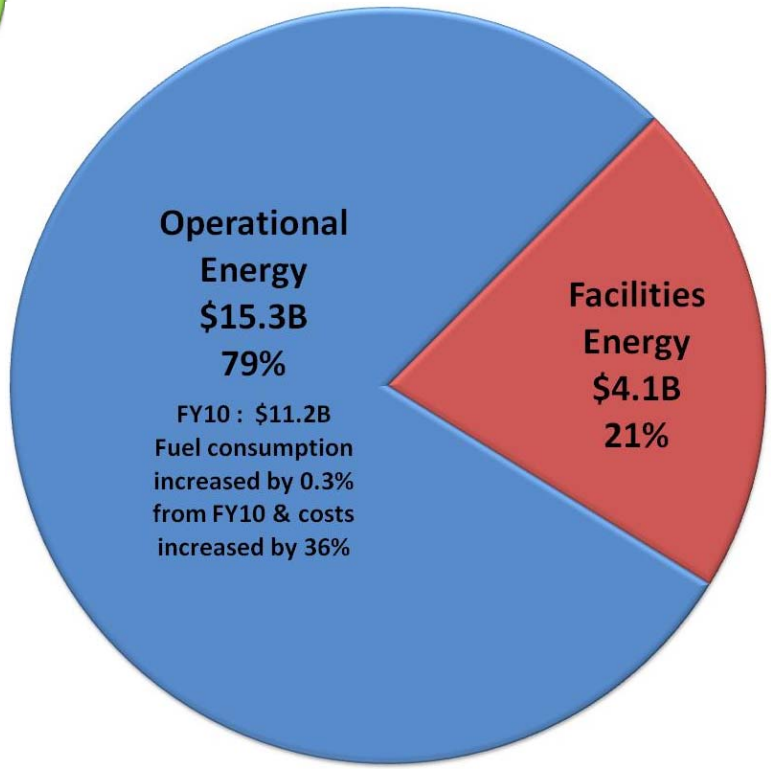


DoD Energy Costs

FY11: $19.4B

FY10: $15.2B





Operational

Installations

* $4.13B in facilities energy costs include non-tactical vehicle fuel
$3.85B – facilities energy
$0.27B – non-tactical vehicle fuel

Why Facility Energy Matters

- Significant Cost
  - FY11: $4.1B (21% of total DoD energy costs)
  - Cost likely to increase as troops return
  - Disproportion share (~ 40%) of GHGs
- Mission Assurance/Energy Security
  - Permanent installations increasingly provide direct support to the warfighter
  - DoD's reliance on a fragile commercial electricity grid places continuity of missions at growing risk [1]

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

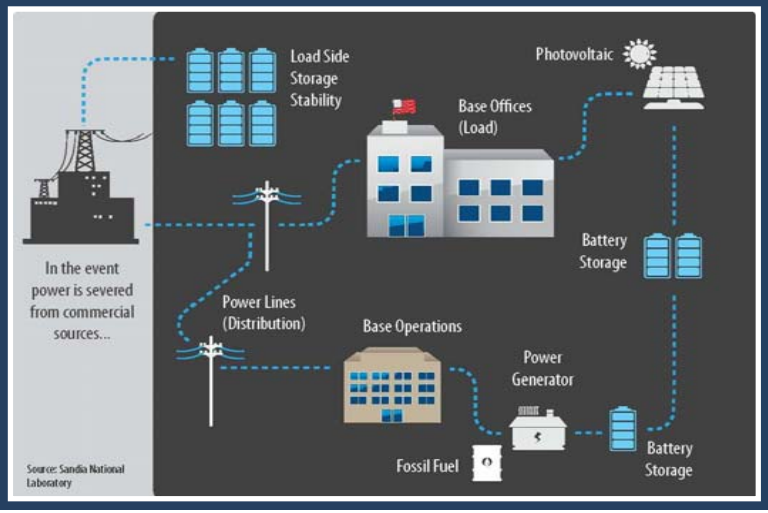
Facility Energy Strategy

Acquisition, Technology and Logistics

Reduce Demand

Expand Supply

Enhance Security



Leverage Advanced Technology

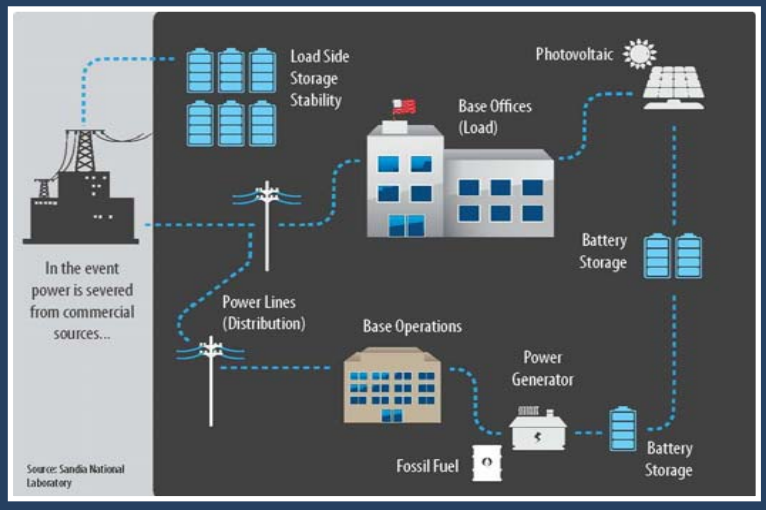
Facility Energy Strategy: Reduce Demand

Acquisition, Technology and Logistics

Reduce Demand

Expand Supply

Enhance Security



Leverage Advanced Technology

Facility Energy Strategy: Reduce Demand

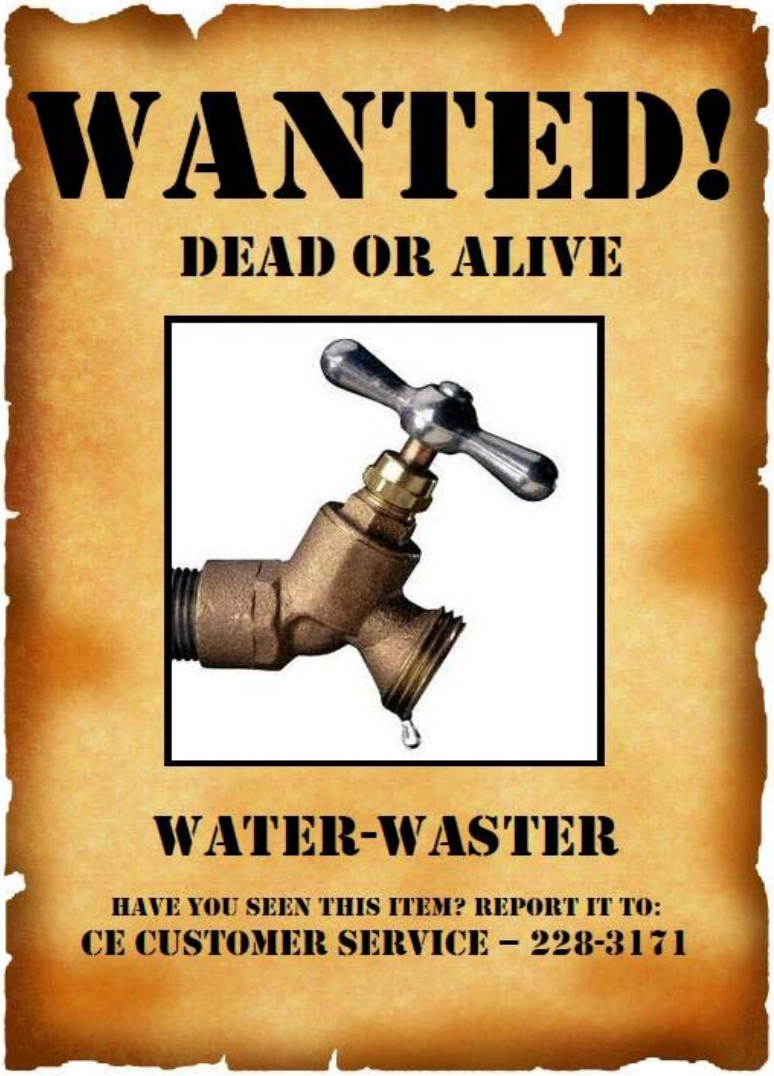
- New Construction
  - LEED Silver (or equivalent), ASHRAE +30%, etc.
  - New Unified Facilities Criteria due in late ’12– will draw on ASHRAE 189.1
- Retrofits
  - $1.1B in FY13 budget
  - Commitment to execute $1.2B in performance-based contracts in FY12-13
- Information Management
  - Updated metering policy (Spring ’12)
  - Enterprise Energy Information Management system (Spring ’12)

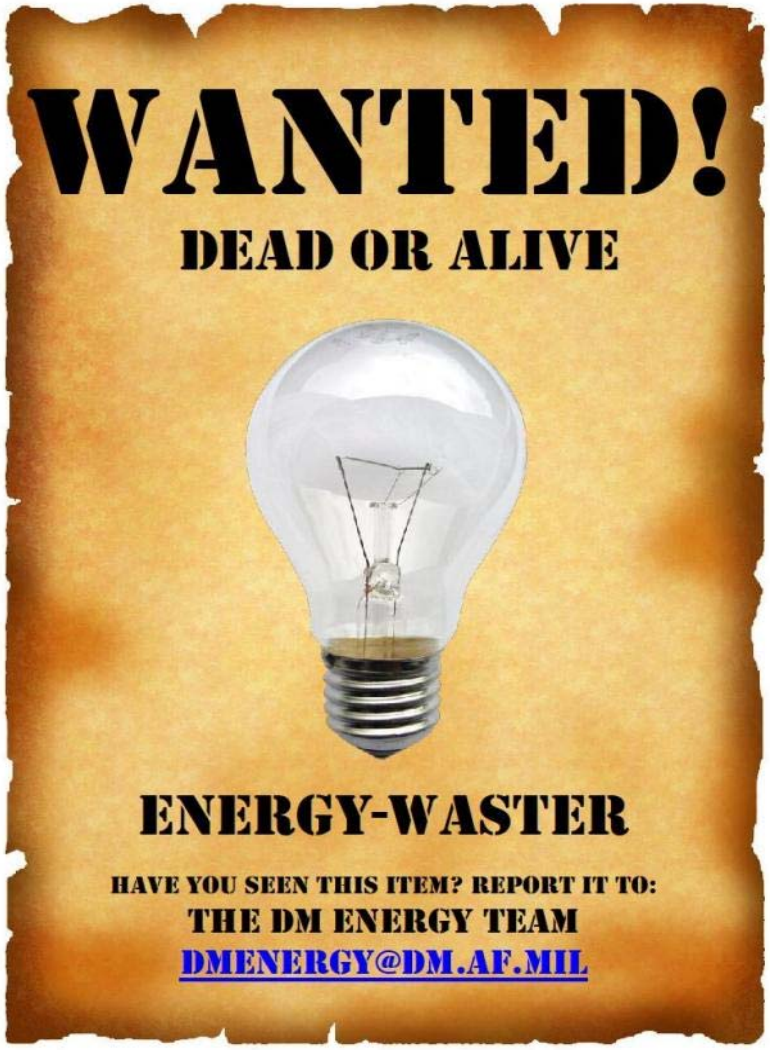
NSWC Corona
(energy retrofits)

Reno ANGB
(shading in building design)

U.S. Air Force Academy
(future LEED Silver)

Facilities Energy Strategy: Reduce Demand



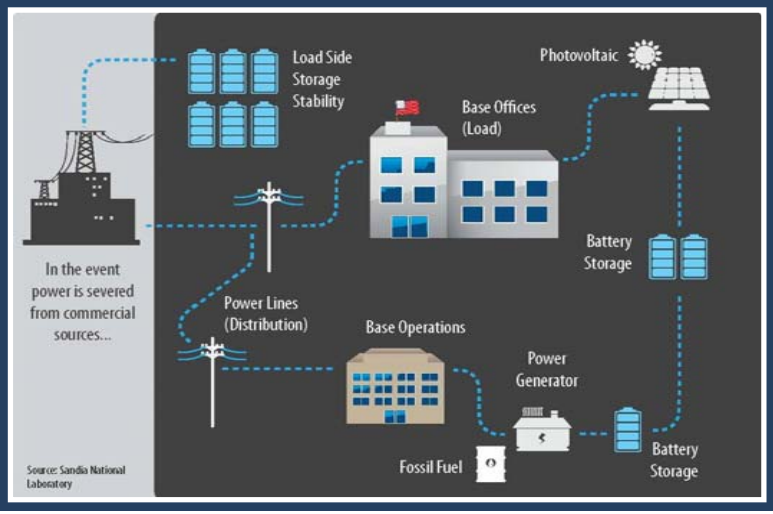


Facility Energy Strategy: Expand On-Site Generation

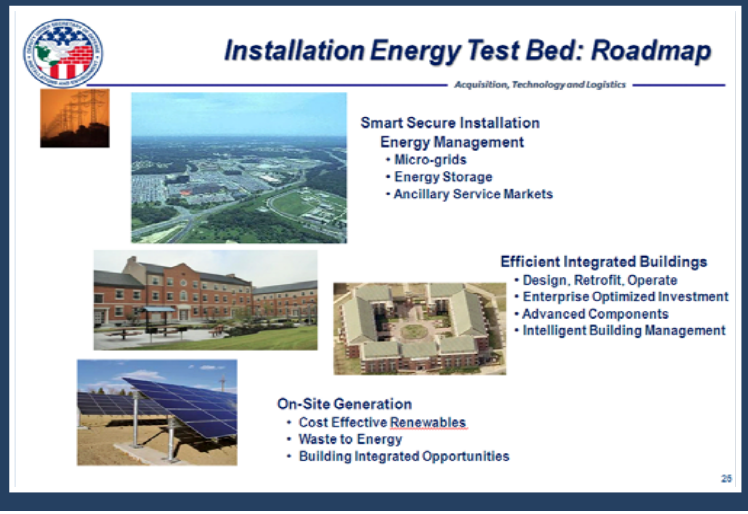
Reduce Demand

Expand On-Site Generation

Enhance Security



Leverage Advanced Technology



Facility Energy Strategy: Expand On-Site Generation

"Defense Department Increases Commitment to Renewable Energy to 3 Gigawatts by 2025"

-Washington, DC, April 10, 2012

"U.S. Air Force To Develop 1 Gigawatt Of Renewable Energy By 2016"

-Bloomberg News
April 11, 2012

"The Department of Defense...will make one of the largest commitments to clean energy in history -- with the Navy purchasing enough capacity to power a quarter of a million homes a year. "

-President Obama,
State of the Union
January 24, 2012

"Army seeks $7.1 B in private investments for renewable energy"

-Announced by Secretary of the Army John McHugh
GovEnergy Conference, August 10, 2011

Facility Energy Strategy: Expand On-Site Generation

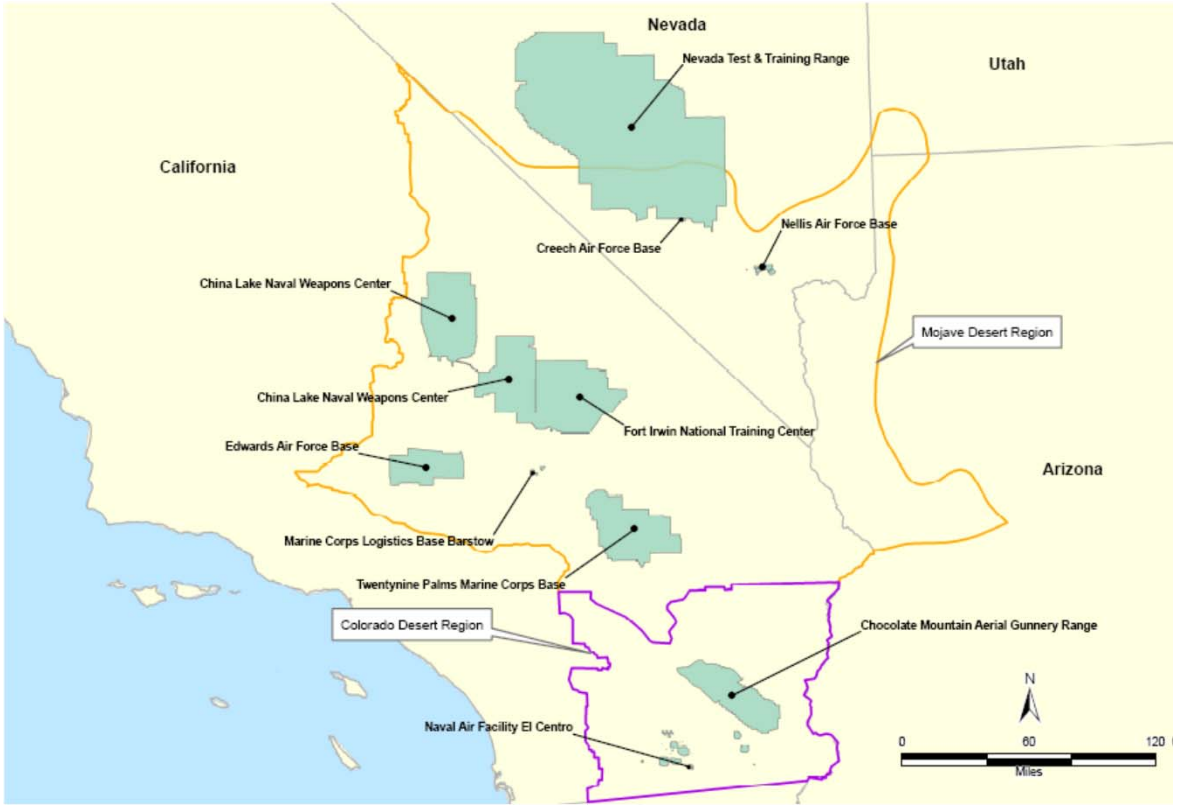
ICF Solar Study

Army: 1
Fort Irwin

Navy: 2
NAWS China Lake
NAF El Centro

Air Force: 3
Edwards AFB
Nellis AFB (including NTTR)
Creech AFB

Marine Corps: 3
MCAGCC Twentynine Palms
MCLB Barstow
Chocolate Mountain Aerial Gunnery Range



Study restricted to land inside installation boundaries including Withdrawn Lands.

Facility Energy Strategy: Expand On-Site Generation

ICF Solar Study

Key Findings:

- 96% of the surface area of the CA installations is technically infeasible due to conflicts (mission, slope, flood hazard, biological & cultural resources)
- 7,000 megawatts (MW) of solar energy development is nevertheless technically feasible and financially viable
- Private developers can tap the solar potential with no capital investment requirement from DoD
- Federal government could potentially receive approximately $100 million/year in rental payments/reduced cost power
- Technical, policy and programmatic barriers exist (transmission, withdrawn land management)

Facility Energy Strategy: Expand On-Site Generation

Army

Tooele Army Depot

Fort Carson

Facility Energy Strategy: Expand On-Site Generation

Navy

NAWS China Lake Geothermal

Ford Island Runway PV Project

Facility Energy Strategy: Expand On-Site Generation

Air Force

FE Warren Air Force Base

Air Force Academy

Nellis Air Force Base

Facility Energy Strategy: Expand On-Site Generation

Solar PV on Privatized Housing

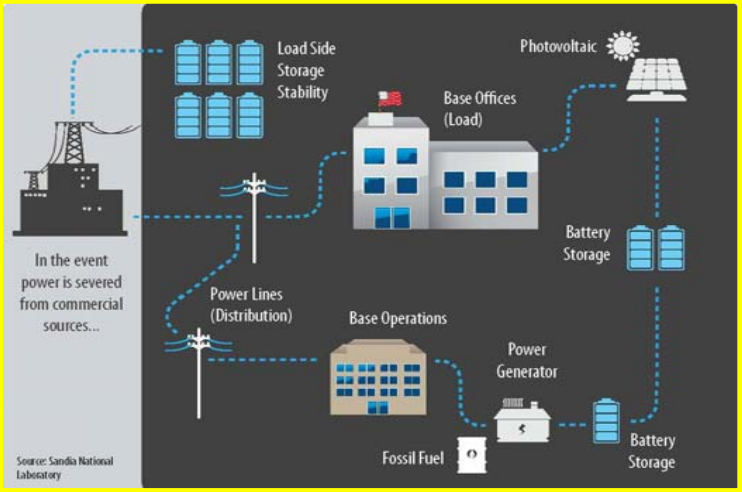
Facility Energy Strategy: Improve Energy Security

Acquisition, Technology and Logistics

Reduce Demand

Expand On-Site Generation

Improve Energy Security



Leverage Advanced Technology

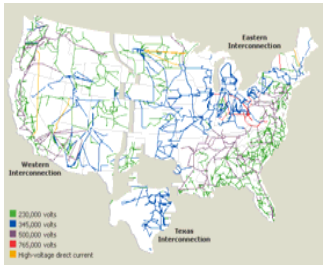
Microgrids are a triple play for DoD:

- Reduce energy costs by allowing for load balancing and demand response
- Facilitate the incorporation of renewable and other on-site energy
- Allow an installation to maintain mission-critical loads if the grid goes down

Microgrid (conceptual)

US Electric Grid

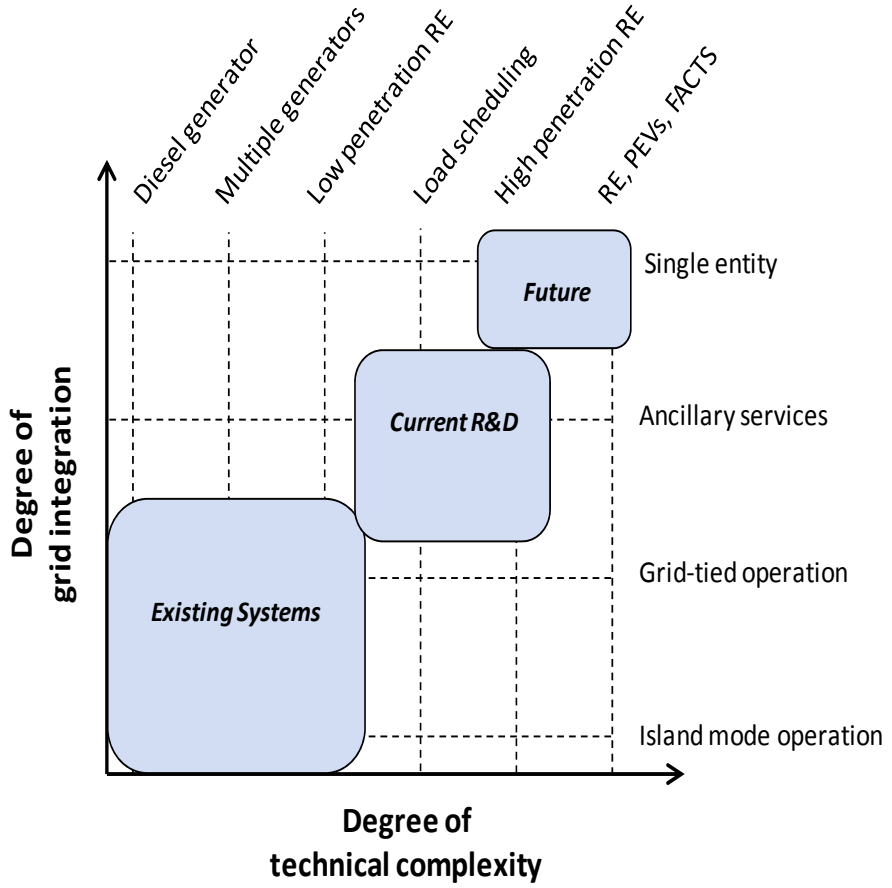
Interconnected grid



High voltage transformers

Microgrid Path

- Key challenges
  - Networking multiple generators
  - Introduction of renewable generation
    - Higher penetrations potentially provide greater benefit
  - Faster system response
  - Seamless integration
  - Cybersecurity



Analytical Studies Underway:

- MIT/Lincoln Lab
  - Classify different M/G architectures
  - Compare relative cost-effectiveness
- ICF International
  - Case studies of 3 installations
  - Opportunities to use M/G and other energy security technologies (e.g., on-site generation, electric V2G) to reduce costs and generate revenue
- Business Executives for National Security (BENS)
  - Alternative business models
  - Appropriate scale and scope
  - Impediments to deployment

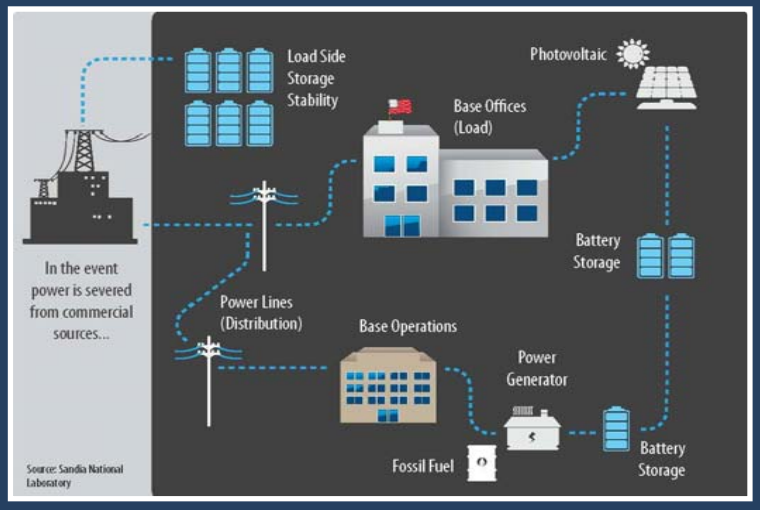
Facility Energy Strategy: Leverage Advanced Technology

Acquisition, Technology and Logistics

Reduce Demand

Expand On-Site Generation

Improve Energy Security



Leverage Advanced Technology

Facility Energy Strategy: Leverage Advanced Technology

- Use bases as distributed test bed to demonstrate promising pre-commercial technologies
- Led by Environmental Security Technology Certification Program (ESTCP) and modeled after DoD's highly successful program for "dem-val" of environmental technology
- Variation on traditional DoD innovation model (e.g., DARPA)

SERDP
DOD ▪ EPA ▪ DOE

Science and Technology

ESTCP

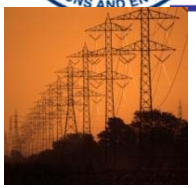
Demonstration/Validation

Installations: Test Bed for Pre-Commercial Energy Technology

- Emerging technologies hold the promise of dramatic improvements in facility energy performance but face major impediments to commercialization and deployment
  - Building industry is highly fragmented
  - First user bears significant costs
  - A&E firms face liabilities but do not share in savings
  - Lack of operational testing deters potential adopters
- DoD is uniquely positioned to help overcome these barriers
  - 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)

ESTCP Installation Energy Test Bed Roadmap

Acquisition, Technology and Logistics



Smart Secure Installation Energy Management

- Microgrids
- Energy Storage
- Ancillary Service Markets

Efficient Integrated Buildings

- Design, Retrofit, Operate
- Enterprise Optimized Investment
- Advanced Components
- Intelligent Building Management

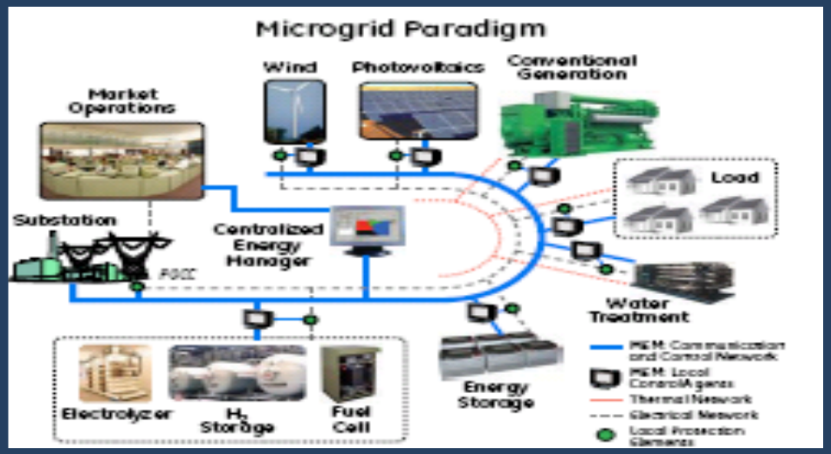
On-Site Generation

- Cost Effective Renewables
- Waste to Energy
- Building Integrated Opportunities

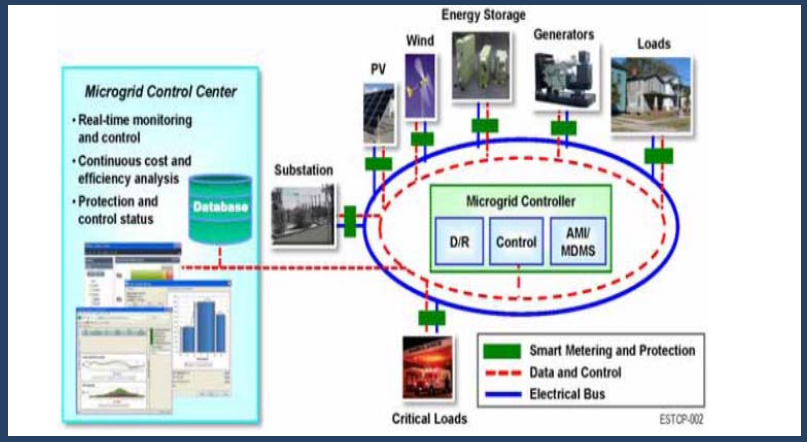
Installation Energy Test Bed: Smart Secure Installation Energy Management

Acquisition, Technology and Logistics

Smart Microgrid at 29 Palms

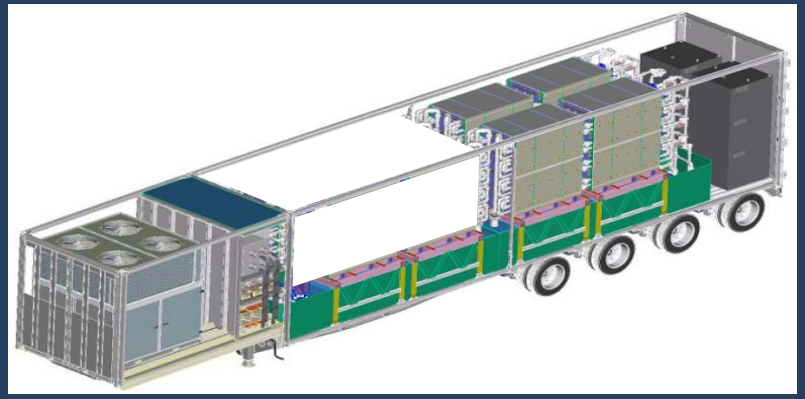


Lockheed Martin Microgrid at Ft. Bliss



Sodium-Metal-Halide Battery Energy Storage System at 29 Palms

Zinc Bromide Flow Battery at MCAS Miramar



- Microgrids, Energy Storage & Ancillary Service Markets
  - Four ongoing demonstration projects
    - Lead Organizations: GE (2), UTRC and Lockheed Martin
      - Two to be completed this year
      - 29 Palms, Ft. Bliss, Joint Base McGuire-Dix-Lakehurst
  - FY 2012 : 6 new demonstration projects
    - Lead Organizations: Eaton, GE, Satcon, Raytheon, LBNL, Honeywell
      - 29 Palms, Ft. Bliss, Ft. Detrick, Ft. Irwin, MCAS Miramar, LA AFB, Ft. Sill
    - Four different energy storage approaches
    - Two ancillary services demonstrations

Installation Energy Test Bed: Efficient Integrated Buildings

Acquisition, Technology and Logistics

Electrochromic Windows

Boiler Efficiency

Nano Technology HVAC (Membrane Dehumidification)

Solar AC

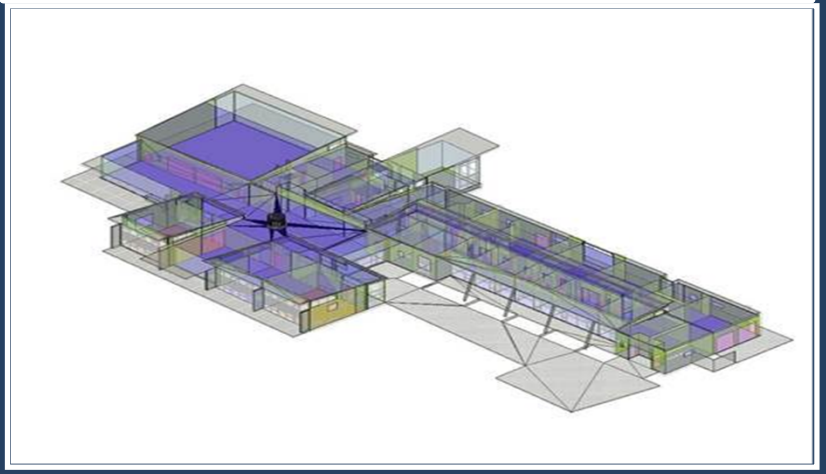
Installation Energy Test Bed: Efficient Integrated Buildings

Acquisition, Technology and Logistics

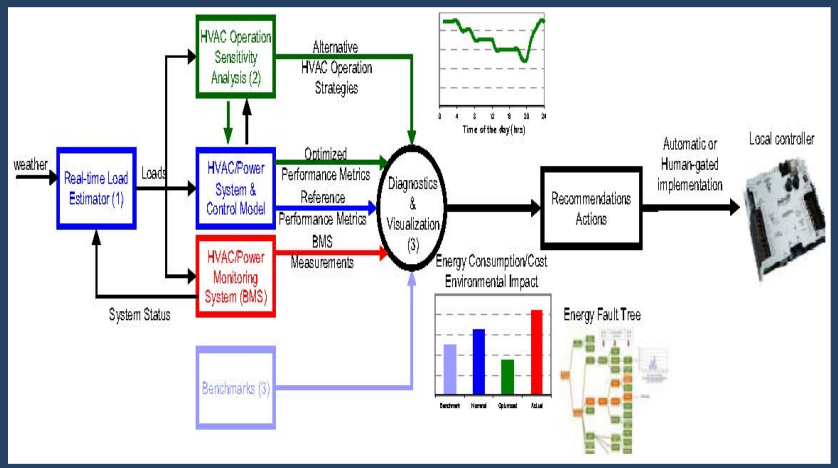
Rapid Building Energy Assessment

Drive-By Thermal Imaging

Building Energy Modeling



Continuous Building Commissioning



Installation Energy Test Bed: Efficient Integrated Buildings

Acquisition, Technology and Logistics

- Design, Retrofit & Operate: Enterprise Optimized Investment, Advanced Components & Intelligent Building Management
  - 22 active projects
    - UTRC, Philips Research, 3M, PNNL, NREL, NFESC, ERDC-CERL, and many small companies and universities
    - Located on Army, Navy, Air Force and Marine Corps installations across CONUS
  - FY 2012 : 17 new demonstration projects
    - UTRC, 3M, Autodesk, Siemens, Honeywell, LBNL, NREL, ERDC-CERL, Army/AF Exchange, Naval District Washington, NFESC and multiple small companies

Installation Energy Test Bed: On-Site Generation

Acquisition, Technology and Logistics

Integrated Roof

Low-BTU Landfill Gas Microturbine

Grid Parity Solar Power

Concentrating PV System

Installation Energy Test Bed: On-Site Generation

Acquisition, Technology and Logistics

Solar Air Heated Roofs

Morgan Solar Sun Simba

Biomass Gasifier

Waste to Energy Gasifier

Installation Energy Test Bed: On-Site Generation

- Cost Effective Renewable, Waste-to-Energy & Building Integrated Technologies
  - 15 ongoing demonstration projects
    - Infinia, Nanosolar, FlexEnergy, American Solar, Skyline Solar, Electricore, Infoscitex
    - Located on Army, Navy, Air Force and Marine Corps installations across CONUS
  - FY2012: 4 new demonstration projects
    - Cogenra, Ener-G-Rotors, Morgan Solar, Southern Research Institute

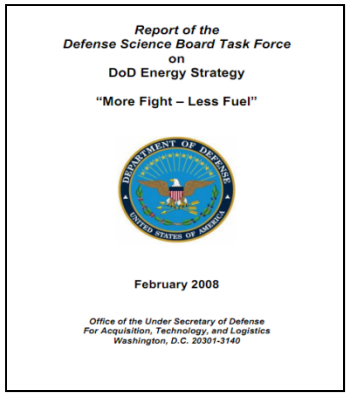
DOE-DOD Energy Security MOU

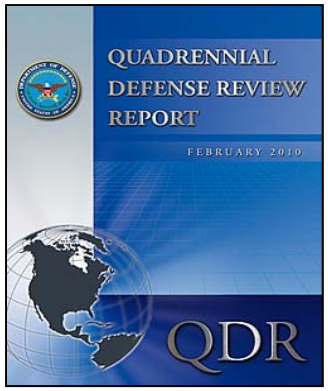
Acquisition, Technology and Logistics

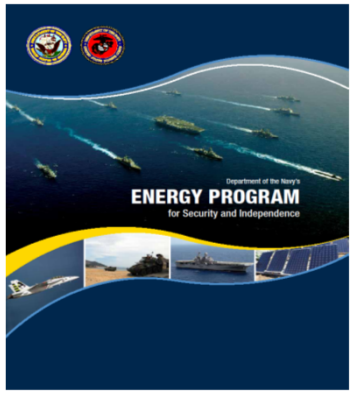
"Concerning Cooperation in a Strategic Partnership to Enhance Energy Security"

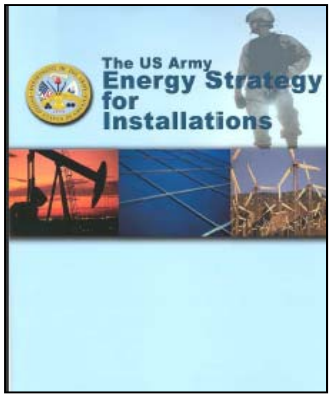
The Purpose:

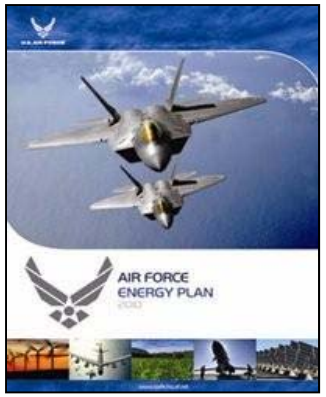
- Identify a framework for cooperation and partnership between the Department of Energy (DOE) and the Department of Defense (DOD)
- Strengthen coordination of efforts to enhance national energy security, and demonstrate Federal Government leadership in transitioning America to a low carbon economy









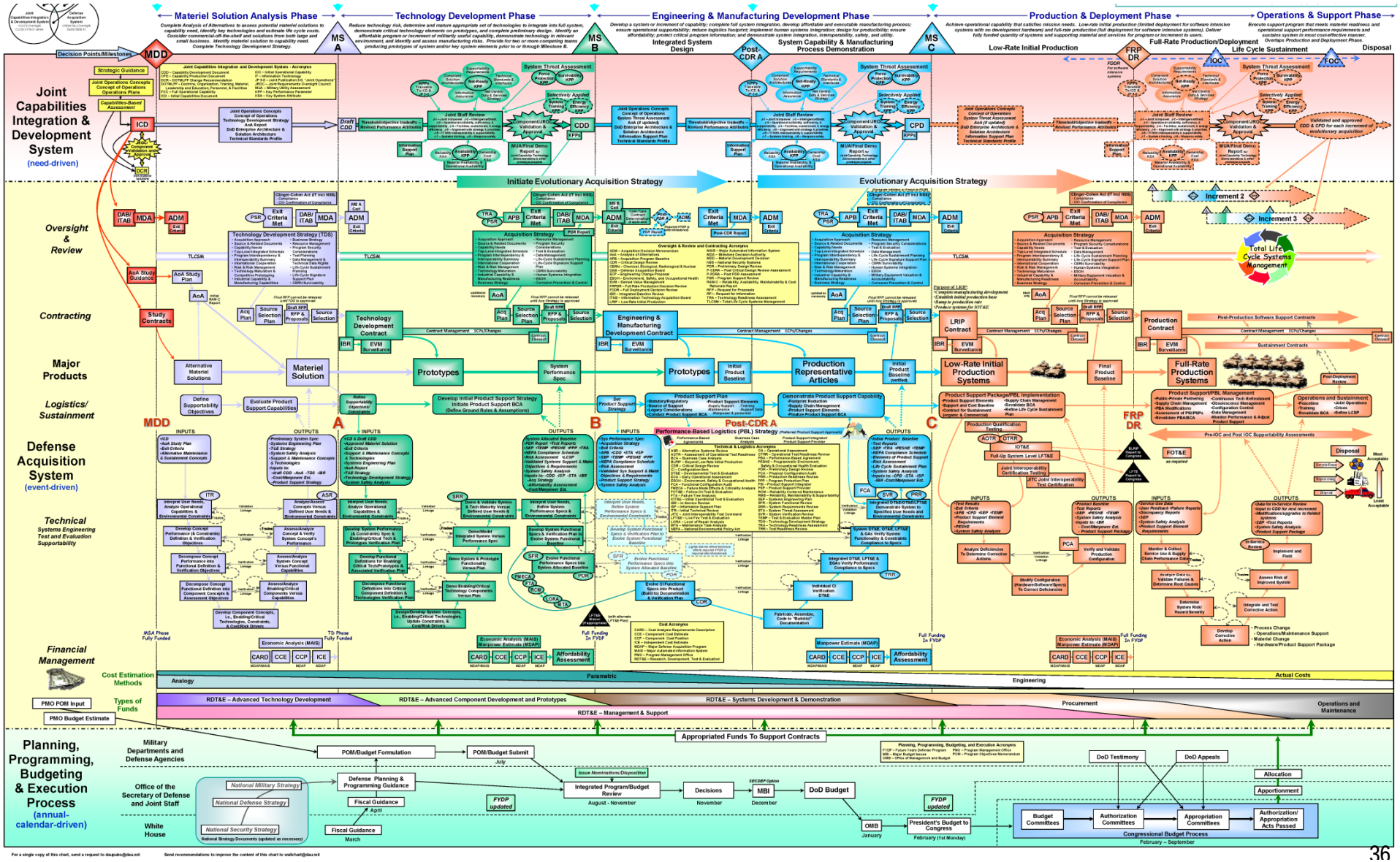


Conclusion

- DoD is pursuing a multi-pronged facility energy strategy both to reduce energy costs and to improve the energy security of our installations.
- Renewable and on-site generation, if connected to advanced microgrid and storage technology, can contribute to energy security in particular.
- The Services have ambitious renewable energy efforts underway. Although we have “the land and the demand,” we are not (yet) agile.
- With their 300k buildings and thousands of acres of solar-compatible land, military installations can be a significant platform for innovation through the demonstration and validation of new technologies.
- DoD and DoE are natural partners in the mission of applying technology to improve energy security.

Integrated Defense Acquisition, Technology and Logistics Life Cycle Management System

Acquisition, Technology and Logistics



Back Up