

**“In the 21<sup>st</sup> Century, the reality is that there are environmental threats which constitute threats to our national security... climate change has a dramatic impact on national security: [from] rising sea levels, to severe droughts, to the melting of the polar caps, to more frequent and devastating natural disasters all raise demand for humanitarian assistance and disaster relief. ”**

**Secretary Leon E. Panetta  
Environmental Defense Fund Reception  
May 2, 2012**



## Key Points

Acquisition, Technology and Logistics

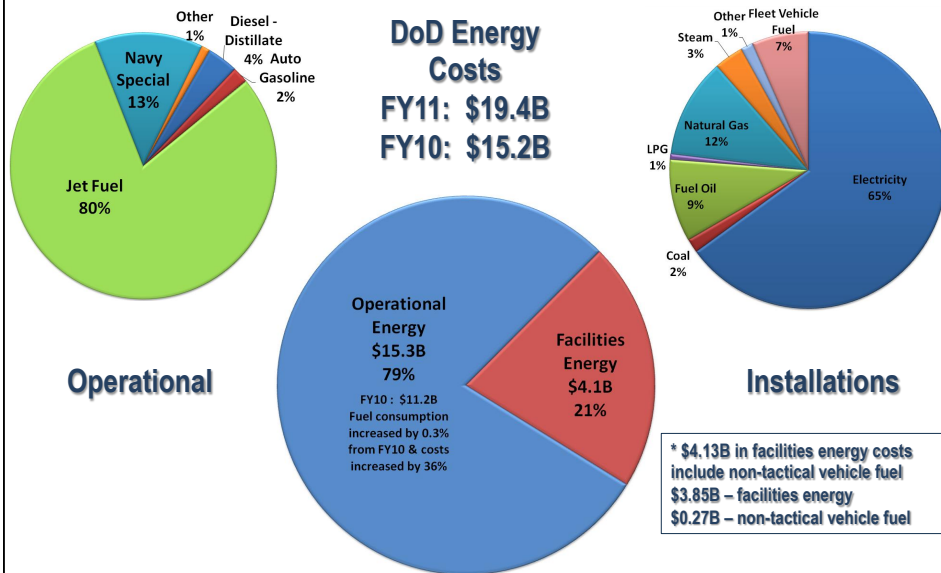
- DoD's effort to reduce its high level of facility energy consumption is driven by mission considerations— cost and energy security.
- Renewable energy— combined with advanced microgrid and storage technologies— can significantly improve the energy security of our military installations.
- As a technology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

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## DoD Energy Costs, FY2011

Acquisition, Technology and Logistics



3



## DoD's Built Infrastructure

Acquisition, Technology and Logistics



298,897 buildings



2.3 billion square feet

160,000 Fleet Vehicles



4



## DoD's Natural Environment

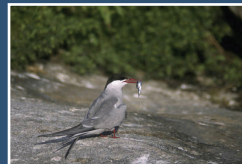
Acquisition, Technology and Logistics



29 million acres



420 endangered species



Broad diversity of ecosystems



5



# Why Facility Energy Matters

Acquisition, Technology and Logistics

- **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 <sup>1</sup>

<sup>1</sup> Defense Science Board, "More Fight – Less Fuel," February 2008



# Facility Energy Strategy

Acquisition, Technology and Logistics

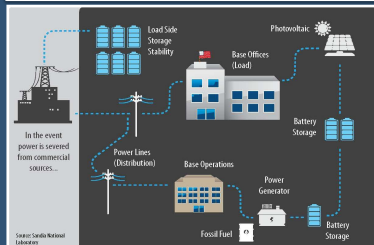
## Reduce Demand



## Expand Supply



## Enhance Security



## Leverage Advanced Technology

**Installation Energy Test Bed: Roadmap**

Smart Secure Installation Energy Management

- Micro-grids
- 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



# Facility Energy Strategy: Reduce Demand

Acquisition, Technology and Logistics

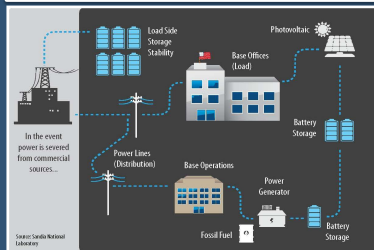
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# Facility Energy Strategy: Reduce Demand

Acquisition, Technology and Logistics

- **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

Changing the Culture

Acquisition, Technology and Logistics

## WANTED!

DEAD OR ALIVE



### WATER-WASTER

HAVE YOU SEEN THIS ITEM? REPORT IT TO:  
CE CUSTOMER SERVICE - 223-3171

## WANTED!

DEAD OR ALIVE



### ENERGY-WASTER

HAVE YOU SEEN THIS ITEM? REPORT IT TO:  
THE DM ENERGY TEAM  
[DMENERGY@DM.AF.MIL](mailto:DMENERGY@DM.AF.MIL)



# Facility Energy Strategy: Expand On-Site Generation

Acquisition, Technology and Logistics

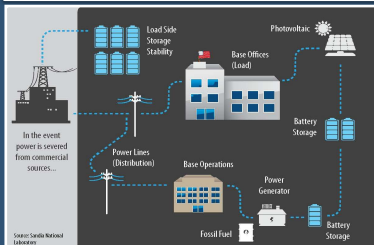
## Reduce Demand



## Expand On-Site Generation



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## Facility Energy Strategy: Expand On-Site Generation

Acquisition, Technology and Logistics

### “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

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## Facility Energy Strategy: Expand On-Site Generation

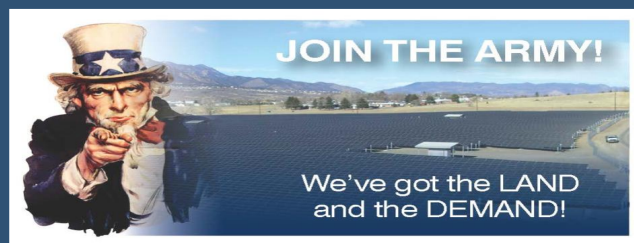
Army

Acquisition, Technology and Logistics

Fort Stewart



Fort Carson



13



# Facility Energy Strategy: Expand On-Site Generation

Navy

Acquisition, Technology and Logistics

NAWS China Lake Geothermal



NAWS China Lake PV



Ford Island Runway PV Project



14



# Facility Energy Strategy: Expand On-Site Generation

Air Force

Acquisition, Technology and Logistics

FE Warren Air Force Base



Air Force Academy



Nellis Air Force Base



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## Facility Energy Strategy: Expand On-Site Generation

### Solar PV on Privatized Housing

Acquisition, Technology and Logistics

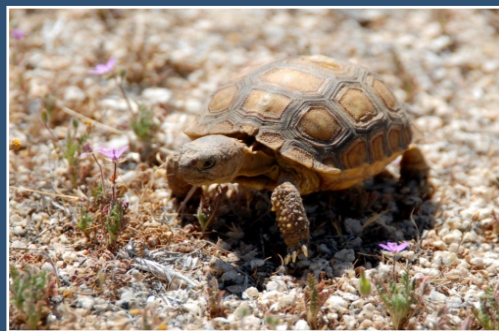


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## Facility Energy Strategy: Expand On-Site Generation

Acquisition, Technology and Logistics



“We’re being out-foxed by the desert tortoise. The expression should be ‘out-tortoisied’.”

- CA Governor Jerry Brown

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# Facility Energy Strategy: Improve Energy Security

Acquisition, Technology and Logistics

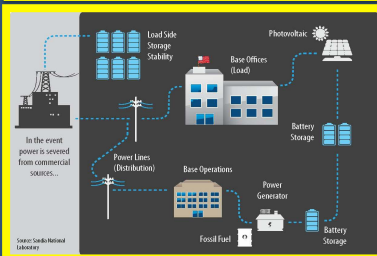
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## Expand On-Site Generation



## Improve Energy Security



## Leverage Advanced Technology

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# Facility Energy Strategy: Improve Energy Security

DoD and Microgrids

Acquisition, Technology and Logistics

## 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





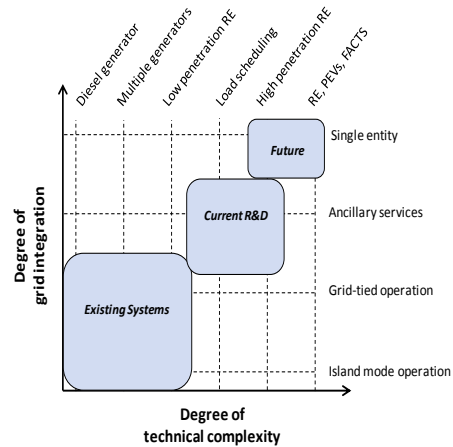
## Facility Energy Strategy: Improve Energy Security

DoD and Microgrids

Acquisition, Technology and Logistics

### Microgrid Path

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



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## Facility Energy Strategy: Improve Energy Security

DoD and Microgrids

Acquisition, Technology and Logistics

### 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

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# Facility Energy Strategy: Leverage Advanced Technology

Acquisition, Technology and Logistics

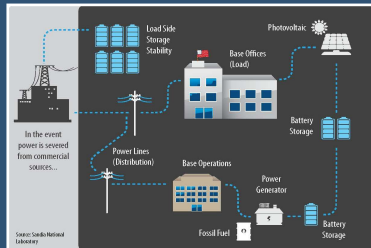
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# Facility Energy Strategy: Leverage Advanced Technology

Acquisition, Technology and Logistics

- 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 "demonstration" of environmental technology
- Variation on traditional DoD innovation model (e.g., DARPA)



Science and Technology





## Installations: Test Bed for Pre-Commercial Energy Technology

Acquisition, Technology and Logistics

- 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)

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## 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
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- On-Site Generation**
- Cost Effective Renewables
    - Waste to Energy
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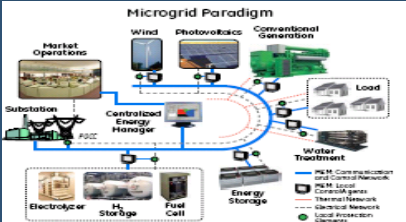
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# Installation Energy Test Bed: Smart Secure Installation Energy Management

Acquisition, Technology and Logistics

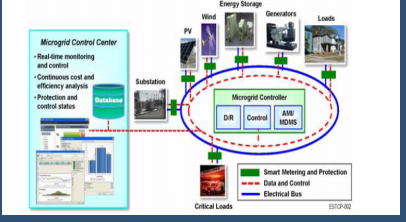
## Smart Microgrid at 29 Palms (GE)



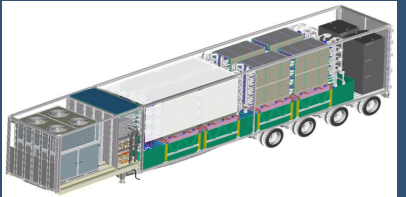
## Sodium-Metal-Halide Battery Energy Storage System at 29 Palms (GE)



## Microgrid at Ft. Bliss (Lockheed Martin)



## Zinc Bromide Flow Battery at MCAS Miramar (Raytheon)



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# Installation Energy Test Bed: Efficient Integrated Buildings

Acquisition, Technology and Logistics

## Electrochromic Windows (Soladigm)



## NanoAir (Dais Analytic)



## Boiler Efficiency (UTC)



## Solar AC (Southern Research Institute)



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## Installation Energy Test Bed: Efficient Integrated Buildings

Acquisition, Technology and Logistics

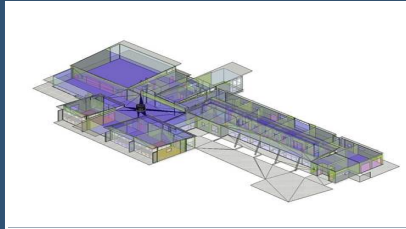
### Rapid Building Energy Assessment (FirstFuel)



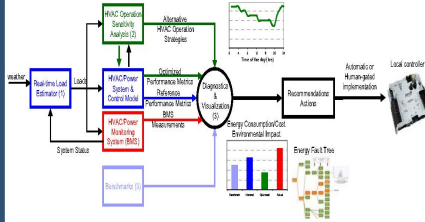
### Drive-By Thermal Imaging (Eye-R Systems)



### Building Energy Modeling (Autodesk)



### Continuous Building Commissioning (UTC)



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## Installation Energy Test Bed: On-Site Generation

Acquisition, Technology and Logistics

### Integrated Roof (Metal Construction Association)



### Low-BTU Landfill Gas Microturbine (FlexEnergy)



### Grid Parity Solar Power (NanoSolar)



### Concentrating PV System (Electricore Inc.)



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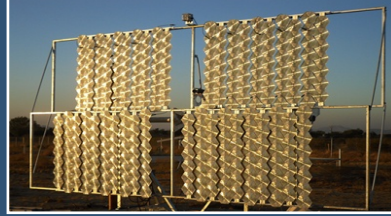
## Installation Energy Test Bed: On-Site Generation

Acquisition, Technology and Logistics

### Solar Air Heated Roofs (American Solar)



### Sun Simba (Morgan Solar)



### Biomass Gasifier (Community Power Corporation)



### Waste to Energy Gasifier (IST Energy)



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## Partnership between ESTCP and DOE's SunShot Initiative

Acquisition, Technology and Logistics

- SunShot goal: decrease total costs of solar energy systems by 75% by 2020
- SunShot 's SUNPATH competition recently awarded funds to 3 US firms
- DoD will demonstrate Soitec Solar's CPV modules at two bases--Ft. Irwin, CA (1MW) and another site TBD (1 MW)
  - DOE pays for modules, DoD for bal of systems and cost to install
- DoD gets advanced RE tech; DOE/Soitec get rigorous dem-val by potentially large customer



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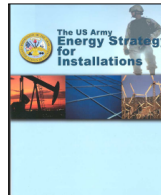
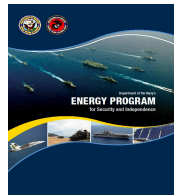
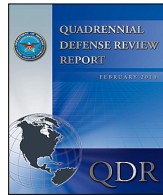
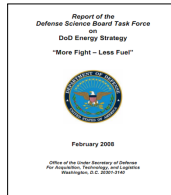
## DOE-DOD Energy Security MOU

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



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## Conclusion

Acquisition, Technology and Logistics

- 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.

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