Managing Operational Energy

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DoD Energy Use: $13.7B in FY10

Total U.S. Energy Use

Federal Energy Use

DOD Energy Use

Service Operational Use

Federal Energy Use 1%
Rest of United States 99%

DOD Energy Use 80%
Other Federal 20%

Operational Use 75%
Installations Use 25%

Army 16.9%
Navy/MC 28.0%
Air Force 54.6%
Other DOD .5%

1 EIA Annual Energy Report 2009, Figures by consumption
2 FY 09 EIA U.S. Government Energy Consumption by Agency, figures by consumption
3 FY 09 DOD Annual Energy Management Report, figures by site delivered BTUs
4 FY10 DLA Energy Net Fuel Sales, figures by sales
Operational Energy is the energy required for training, moving, and sustaining military forces and weapons platforms for military operations. The term includes energy used by tactical power systems and generators and weapons platforms.”

- Increased energy efficiency of military operations
- Increasing energy consumption means:
  - Increasing costs
  - Increasing risks -- tactical, operational, strategic

Why Manage Energy at DoD?

Implements Efficiency, Effectiveness, Cost
Iraq & Afghanistan – 3,000 Army personnel or contractors killed or wounded between FY03-07 in attacks on water and fuel convoys

Afghanistan – One Marine wounded for every 50 convoys in 2010
Getting Fuel to the Fight: A Tactical Challenge

Supply Convoys Backed Up at Pakistan’s Torkham Gate

Bundles of fuel dropped from a USAF C-17 over Afghanistan, December 2010
OASD (OEPP) Policy Documents

Operational Energy Strategy:
Implementation Plan

Department of Defense
March 2012
Vision: Energy will be a strategic advantage for U.S. military forces

Increase Operational Energy Efficiency

Institutionalize Operational Energy

Expand Operational Energy Supply

Defense.energy.mil
16 sites studied in Aug 2011:

- Electric power generation consumes >40% of fuel
- HVAC units consume power inefficiently because many units are improperly sized & poorly controlled
- Spot electrical generation is used sub-optimally
- Centralized power plants have been very reliable & improved fuel use efficiency
- Renewable energy is minimally employed for power grids & lighting ( < 1%)
1. US Marines @ Patrol Base Boldak reduced fuel demand 20%
2. 28kW solar array supplanted diesel generators at four company-sized camps
3. Centralized power plants @ 5 bases; will replace 620 spot generators and reduce fuel demand 15-25%
4. 300W Zero Base Regenerator mobile solar system

5. 1MW microgrid...reduced fuel demand 17% and generator run time 85%

6. tactical solar power or fuel cell systems
## Army P & E Challenges & Goals

### Ground Vehicles

**Prime Power**

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**Energy Storage**

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**Motors**

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**Power Conditioning**

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**Pulse Power**

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**GOALS**

- Weight-Efficient Prime Power (3X)
- Balanced Solutions for Platform Energy Storage needs (4X)
- Volume Efficient Motors (3X)
- Solid State/High Temp solutions (6X)
- Solid State/Thin Film solutions (2X)
Army P & E Challenges & Goals
Soldier Power

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<th>GOALS</th>
<th>FY 03</th>
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**JP-8 /Diesel Portable Power**

- **kg**

**Energy Storage (Primary)**

- **W-hr/kg**

**Energy Storage (Rechargeable)**

- **W-hr/kg**

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**Li-MnO2**

- **BA-5390**

**Zinc-Air**

**Li/CFx**

**Li-Ion**

- **BB2590**

**Methanol Fuel Cells**

- **3.5X vs BB2590**

- Less carried weight over 72 hours
Army TARDEC RDT&E

Prime & Non-Primary Power
- Diesel Engines
- Rotary Engines
- JP-8 Fuel Cells
- Integrated Starter Generator
- Turbine Engines
- Alternators
- Drivelines
- Suspension

Energy Storage
- Li-Ion / Ultracap Hybrid Energy Storage
- Capacitors
- Advanced Batteries

Thermal Management
- Radiators
- Heat Recovery
- Phase Change Cooling
- Advanced Electronics Cooling
- Thermal Architectures

Power Management
- Power Controllers for Power Management
- Power Converters/Inverters
- Wide Band Gap Materials (SiC)
- High Temperature SiC Modules
- Pulse Power Switching
- High Temperature Capacitors
- High Temp Inductors

Ground Vehicle Power and Energy Technology
Reducing Energy Consumption of Expeditionary Shelter Systems

1. Spray Foam Insulation significantly reduced energy loads for environmental control, but…
   - Users rarely resized environmental and power equipment, thus did not realize true savings potential
   - Disposal continues to be a challenge; the land fill and shipping options are both proving to be costly

2. Tent liners and LED tent lights continue to flow into theater to be added into existing tentage
DoD Energy Use

Typical DoD Consumption (by BTUs)

- Mobility (aircraft, ships, vehicles): 75%
- Buildings: 24%
- Excluded: 1.5%

Fuel types and percentages:
- Jet Fuel: 53%
- Marine Diesel: 11%
- Electricity: 12%
- Fuel Oil: 3%
- Natural Gas: 8%
- Steam: 1%
- Coal: 2%
- Auto Diesel: 8%
- Auto Gas: 1%
- Other: 0.2%
- Coal: 2%
- Natural Gas: 8%
- Steam: 1%
- Auto Diesel: 8%
- Auto Gas: 1%
- Other: 0.2%
- Fuel Oil: 3%
- Electricity: 12%
- Marine Diesel: 11%
- Jet Fuel: 53%
- Excluded: 1.5%
What Does Success Look Like?

- Improves endurance and range of forces
- Frees combat forces from protecting supply lines to perform operational missions
- Fewer casualties and battle-damage from moving & protecting fuel
- Strengthening DOD’s resilience to energy price and supply volatility and disruption.
- Posturing the future force for success by better aligning resources to tactical, operational, and strategic goals.

By improving how we use energy…
the warfighter can be more effective…
More Fight, Less Fuel

- The Department must:
  - Reduce overall demand for operational energy
  - Improve the efficiency of military energy used to enhance combat effectiveness

- This can be done by:
  - Accelerating and adopting technological and management innovations reducing demand and improving efficiency