FROM BARRACKS TO THE BATTLEFIELD

CLEAN ENERGY INNOVATION AND AMERICA'S ARMED FORCES

THE PEW PROJECT ON
NATIONAL SECURITY, ENERGY AND CLIMATE

The Pew Project

- Established in 2009 to bring together military, economic and environmental minds to discuss the relationship between energy and national security.
- Senator John Warner, senior adviser.

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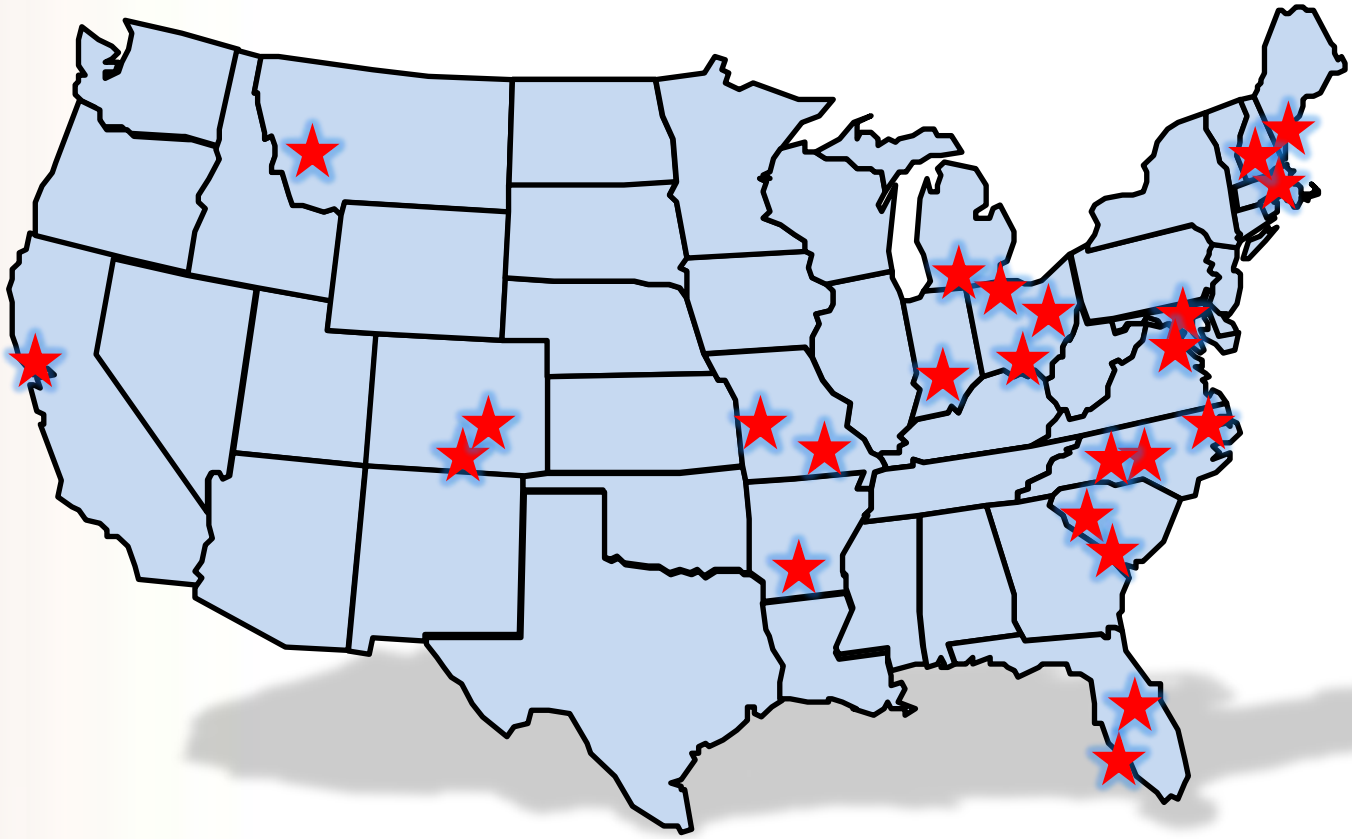
Getting out of Washington



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Public Forums and Base Tours

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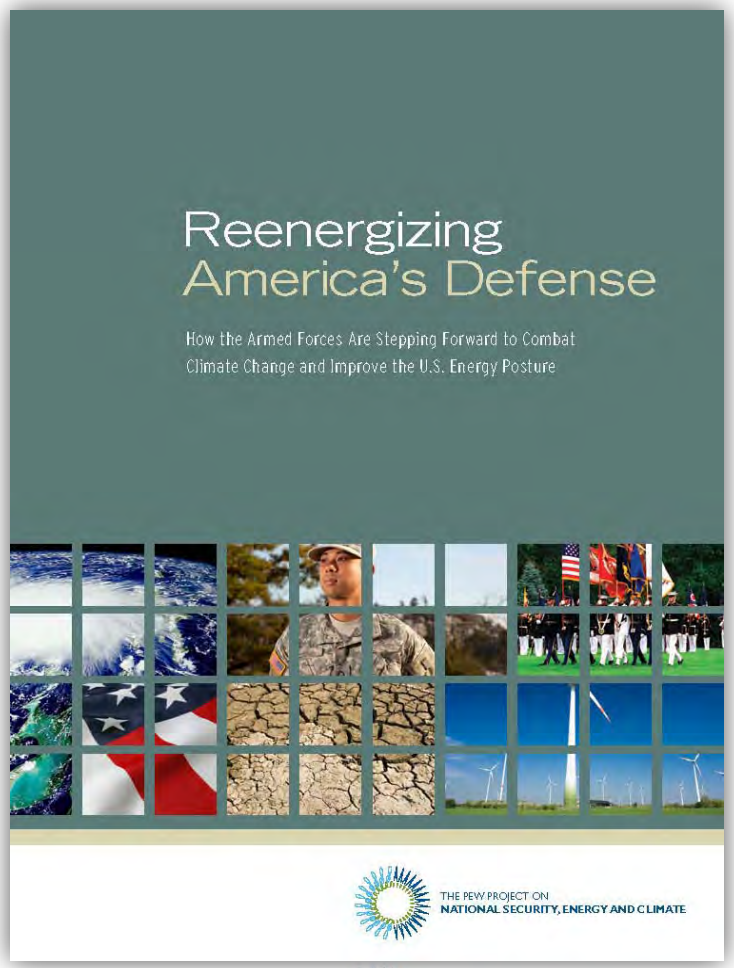
Reenergizing America's Defense

- Examined DoD's reliance on foreign oil and its impact on lives and budget.
- Emphasized military leadership on renewable energy.
- Highlighted aggressive goals for deploying renewable energy technologies.



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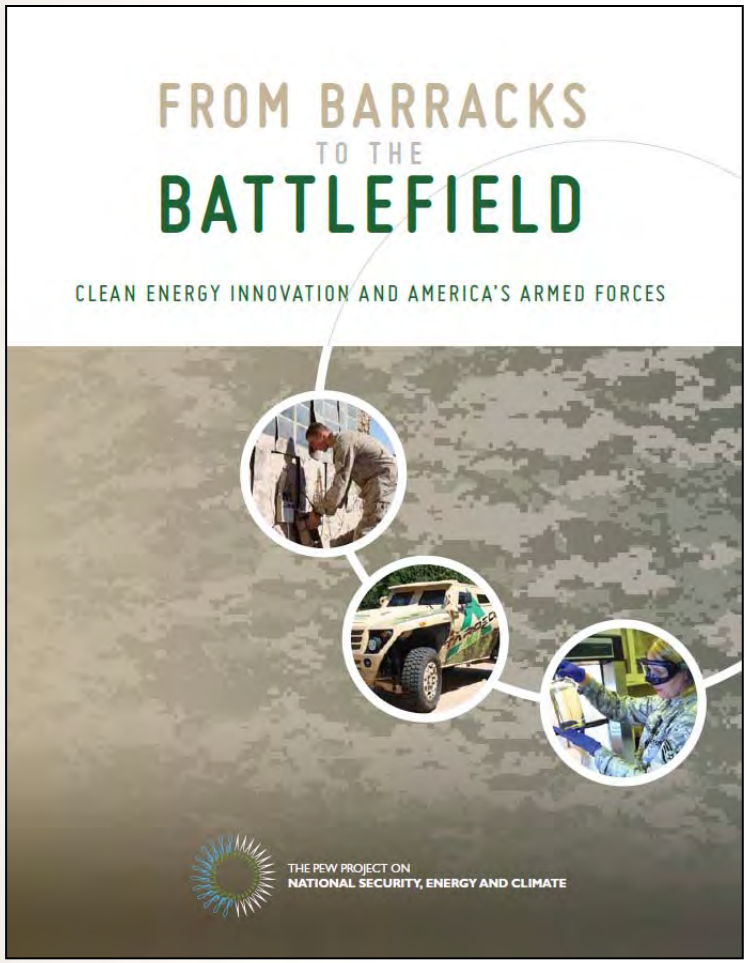

- How is the military using clean energy to improve mission success?
- What role can DoD play to usher commercial clean energy technologies to scale?
- What are the key technologies DoD is utilizing?

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DoD's Energy Challenges

- Largest institutional energy user.
  - Operational Risk
  - Operational Effectiveness
  - Price Volatility
  - Security of Supply

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DoD's Energy Costs

- DoD's energy bill: $15 billion in 2010.
- Every $10 increase in the price of a barrel of oil = increase of $1.3 billion.

DoD's Energy Costs: Operations

- Operational energy = 74% of DoD energy costs.
- American warfighter requires 22 gallons of fuel per day.
- One in 46 resupply convoys attacked; 1,100 attacks on fuel convoys in 2010.

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DoD's Energy Costs: Installations

- Installation energy = 26% of DoD's energy use.
- DoD's facilities and major installations total 2.2 billion square feet.
- Base energy needs to skyrocket as troops return home from overseas.

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What Clean Energy Can Do for DoD

Save lives & money

- **Energy efficient and hybrid engine technology** can reduce fuel requirements.
- **Advanced biofuels** can avoid oil price shocks.
- **Renewable energy and more efficient batteries** into theatre can decrease the need for fuel convoys and improve troop mobility.

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What DoD Can Do for Clean Energy

- Scale, purchasing power, R&D, critical test bed for clean energy technologies.
- DoD's energy security budget has increased 200%.
- Advanced energy investments to reach $10 billion by 2030.

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Vehicles: Aircraft and Ground Vehicles

- Engine efficiency upgrades, especially in airplanes.
- $500 million on operational improvements.
- Thousands of slow-moving electric vehicles at installations.

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Vehicles: Ships

- Navy's Great Green Fleet.
- Efficiency improvements already saving the Navy $450,000 per ship.
- USS Makin Island's hybrid electric propulsion system will save $250M over lifetime of the ship.

Vehicles

- **Scale & Early Adoption**: non-tactical fleet of over 190,000 heavy and medium duty vehicles.
- **Work with private sector**: RFI with EV industry players to make EVs cost competitive.
- **Conduct R&D**: TARDEC's Ground System Power and Energy Facility set to open later this year.

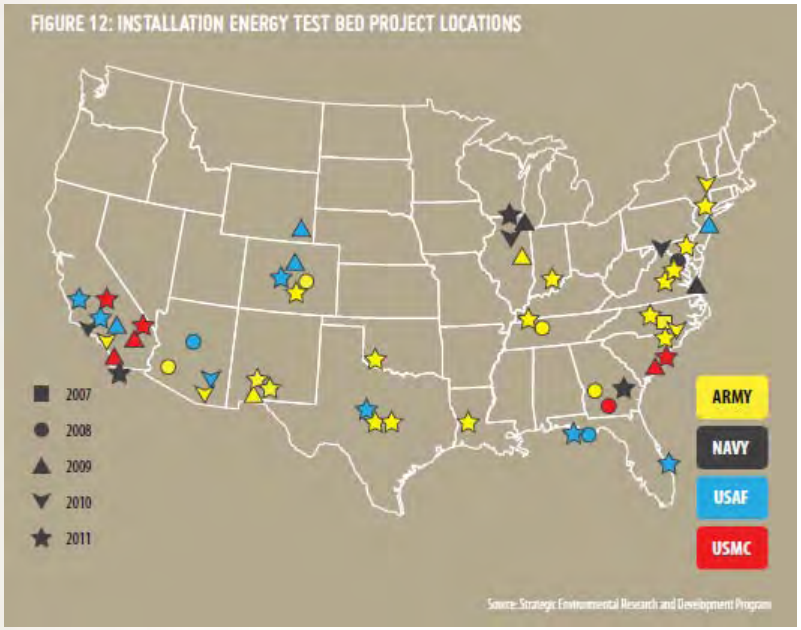
Advanced Biofuels

- Domestically produced biofuels avoid price shocks and won't need to be imported from unstable regions of the world.
- Drop-in fuels don't require any upgrades to fleet engines.
- DoD conducts operations all over the globe.

What DoD Can Do for Advanced Biofuels

- **Purchasing power**: Navy will need 3.36 million gallons by 2016 to meet strategic goals.
- **Work with private sector**: Navy, DoE and USDA investing $510M to co-finance construction of bio refineries.
- **Demonstrate success**: Test flights have led to 50/50 blend tests for commercial flights.

Energy Efficiency/Storage at Bases



- Installation Energy Test Bed Initiative; goal to reduce demand 50% in existing buildings, 70% in new construction.
- 450 renewable energy projects.
- Microgrids to increase energy security.
- $18 billion fund just announced.

Energy Efficiency/Storage at Forward Operating Bases

- Marines deploying portable solar mats and rechargeable batteries to reduce need for fuel convoys.
- India Company– 2 patrol bases on 100% clean energy.
- Three-week-long foot patrol required no battery resupply, saved 700lbs of weight.

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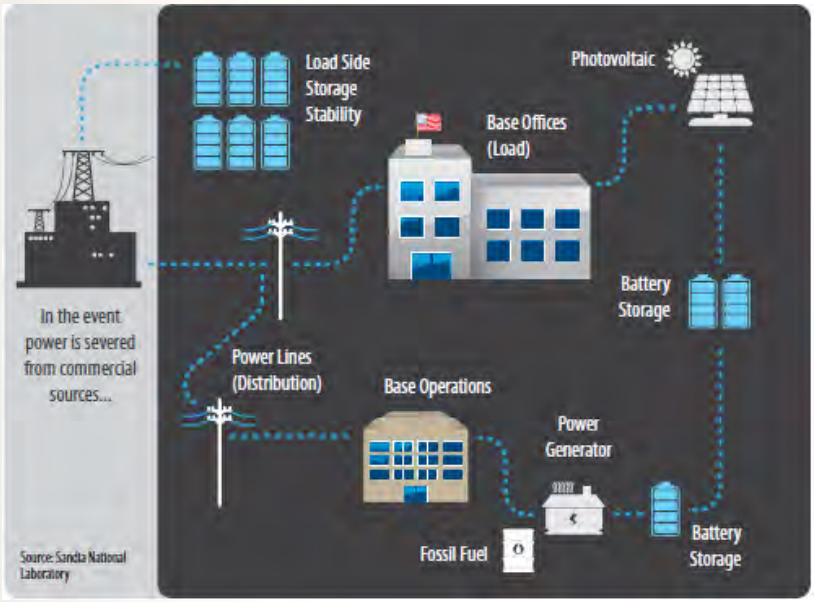
What DoD Can Do for Energy Efficiency/Storage



- **Purchasing power**: DoD microgrid market expected to grow 375% to $1.6 billion in 2020.
- **Conduct R&D**: DARPA leading effort to achieve 50% efficiency in solar panels.
- **Work with private sector**: DoD sharing fuel cell performance data with commercial sector.

Conclusion

- Defense Department and clean energy industry mutually beneficial.
- DoD playing critical role in advancement of clean energy technologies.

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