Navy Energy Program

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**Navy Energy Program**

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Resource Challenge: Petroleum

**Price Volatility**

- In 2000, bbl price increased $3.50/yr
- In 2010, bbl price increased $12/yr

**US Crude Oil Supply Trend**

- Imports
- Domestic Supply

**Distribution of Oil Reserves**

Country Size Proportional to Oil Reserves (% World Total)

**Oil Consumption (Mbbl/day)**

- Saudi Arabia 22.3%
- Iran 11.2%
- Iraq 9.7%
- Kuwait 8.4%
- UAE 8.3%


- Domestic Sources 36%
- Other Europe 5%
- Other Africa, Middle East & Asia 5%
- Other Caribbean, Central & South America 6%
- Mexico 7%
- Canada 12%
- Domestic Sources 36%
- OPEC 27%

In 2000, bbl price increased $3.50/yr
In 2010, bbl price increased $12/yr
Navy Energy Profile

Overall Energy Consumption

~73%

~27%

Tactical

Shore

Overall Energy Sources

54%

Tactical

16%

1%

Shore

3%

3%

1%

Petroleum Afloat

Nuclear

Electricity, Natural Gas, Other

Electricity, Natural Gas, Other

Petroleum Ashore

Renewables

Navy Petroleum Consumption in Perspective

U.S. Petroleum Consumption

1% Expeditionary

6% Shore

41% Maritime

52% Navy Aviation

Navy (25% of DoD)

Department of Defense (93% of Gov’t)

U.S. Gov’t (2% of U.S.)

Non-Domestic Sources

Total: 29 M bbls in FY08

U.S. Gov’t (2% of U.S.)

Department of Defense (93% of Gov’t)
Navy Strategic Energy Objectives: Primary Focus

Improve Platform Performance

Reduce Costs

Since 1991
- CPI increased 59%
- Manpower costs increased 114%
- Energy costs increased 292%

Ensure Energy Security

Green the Footprint

Surface Combatant Total Ownership Cost (1991–2009)

- Acquisition 40%
- Energy 11%
- Maintenance 15%
- Manpower 27%
- .8X CPI
- 2X CPI
- 5X CPI

Since 1991
- CPI increased 59%
- Manpower costs increased 114%
- Energy costs increased 292%
Navy Strategic Energy Objectives: Collateral Benefit

**Improve Platform Performance**

**Reduce Costs**

Since 1991
- CPI increased 59%
- Manpower costs increased 114%
- Energy costs increased 292%

**Ensure Energy Security**

**Green the Footprint**
SECNAV Energy Goals

- **Sail the Great Green Fleet**
  - Sail the Great Green Fleet
  - 2012 Green Strike Group Demo
  - 2016 Great Green Fleet Sail

- **50% Alternative Energy by 2020**

- **50% Net Zero Installations by 2020**

- **50% Less Petroleum in Commercial Vehicles by 2015**

- **Energy Efficient Acquisition**
Shore Energy Approach

Energy Efficiency First
- Recapitalize our existing infrastructure with energy-efficient systems
- All new construction and major renovation projects must meet LEED Silver standards
  - Energy savings
  - Water efficiency
  - CO₂ emissions reduction
  - Resources stewardship
  - Environmental impact

Navy Culture and Behavior
- Link energy consumption to behavior
- Increased awareness and accountability at individual, command & functional levels
- Energy Audits – base and building level assessments
- Energy Managers
- Advanced Metering Infrastructure and other enabling systems

Integrate Technology
- Watch maturing technology and invest when/where viable (Solar, Wind)
- Partner to develop needed technology with other government organizations or industry (SmartGrid)
- Lead the development of mission critical technologies (Ocean energy for island base)
Maritime & Aviation Efficiency Initiatives

**Efficient Ship Systems**
Example: Solid State Lighting

**Improved Hydrodynamics**
Example: Stern Flaps and Hull Coatings

**DDG-51 Hybrid Electric Drive**
Test Platform: USS TRUXTUN

**Operations & Policy**
Example: Air Energy Conservation Program

**Research & Development**
Example: Engine Modifications

**Science & Technology**
Example: Variable Cycle Engine

Enhance capability by enabling fuel savings and expanding tactical reach
### Why Next Generation?

- **1st-Gen biofuels unacceptable for tactical systems**
  - Fuel degrades rapidly in storage
  - Lower energy density
- **Focused on hydrotreated renewable jet fuel and diesel (HRJ and HRD)**

### Achieving 50% Alternatives Afloat

<table>
<thead>
<tr>
<th>Year</th>
<th>MBbls of Oil Equivalent</th>
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<tbody>
<tr>
<td>2008</td>
<td>28%</td>
</tr>
<tr>
<td>2011</td>
<td>72%</td>
</tr>
<tr>
<td>2014</td>
<td>Liquid Alternatives</td>
</tr>
<tr>
<td>2017</td>
<td>GGF Demo</td>
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<tr>
<td>2020</td>
<td>GGF Deployment</td>
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</tbody>
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### Alternative Fuel Requirements

- **Drop-in compatibility** with existing platforms, equipment, and infrastructure
- **Quantity availability**
  - 2012 Demo – 8K Bbls
  - 2016 Sail – 80K Bbls
  - 2020 50% Alternatives – 8M Bbls
- **Price competitive** with fossil fuel
- **GHG compliant**
  - EISA 2007 Sec. 526
- **Sustainable**
  - Minimize effect of feedstock inputs such as land, water, and fertilizer
Biofuel Companies of Interest

100M gallons in 2015

27M gallons in 2015

1M gallons in 2015

350K gallons in 2015

10K gallons in 2015

10M gallons in 2015

1M gallons in 2015

3M gallons in 2015

10K gallons in 2015

100M gallons in 2015

10K gallons in 2015

120M gallons in 2015

10K gallons in 2015

210M gallons in 2015

10K gallons in 2015

27M gallons in 2015

30M gallons in 2015

30K gallons in 2015

10K gallons in 2015

30K gallons in 2015

1B gallons in 2016
Test and Certification Milestones

**COMPLETE**

- **F/A-18 Super Hornet**  
  April 2010
- **RCB-X**  
  October 2010
- **MH-60S Seahawk**  
  November 2010
- **Allison 501k G/T Generator**  
  January 2011

**UPCOMING**

- **V-22 Osprey**  
  Late Summer 2011
- **AV-8B Harrier II**  
  Late Summer 2011
- **EA-6B Prowler**  
  Late Summer 2011
- **Self Defense Test Ship (SDTS)**  
  Early 2012

*Engineering the fuel not the platform*
### Fleet Composition

<table>
<thead>
<tr>
<th>Ship Type</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aircraft Carrier</td>
<td>![Carrier Image]</td>
</tr>
<tr>
<td>Destroyer</td>
<td>![Destroyer Image]</td>
</tr>
<tr>
<td>Submarine</td>
<td>![Submarine Image]</td>
</tr>
<tr>
<td>Warship</td>
<td>![Warship Image]</td>
</tr>
<tr>
<td>Fighter Jet</td>
<td>![Jet Image]</td>
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</tbody>
</table>

### 2012 Green Strike Group
- All ships and aircraft in demo group certified to run on 50/50 biofuel blend
- One destroyer will contain full load out of 50/50 biofuel or fuel will be split among CG/DDG
- Carrier will contain one tank of 50/50 aircraft biofuel
- CSG will feature fuel saving technologies, e.g. GT improvements, solid state lighting
- CSG will conduct exercise in local operations

### 2016 Great Green Fleet (GGF)
- Each ship will contain full load out of 50/50 biofuel
- Carrier will contain full load out of 50/50 aircraft biofuel
- GGF will include at least one Destroyer featuring Hybrid Electric Drive
- CSG will feature additional fuel saving technologies
- CSG will go on deployment
Being “energy smart” – requires a Spartan mindset to ensure mission accomplishment... in perpetuity.
Recent Energy Successes

- China Lake Geothermal Power Plant, 270 MW
- Shipboard Incentivized Energy Conservation Program (i-ENCON)
- Guantanamo Bay Wind Farm
- Aviation Training Simulators
- San Diego Solar PV
For More Information:

Check out our Energy, Environment and Climate Change website at www.greenfleet.dodlive.mil

You can ‘Like’ Task Force Energy on facebook at www.facebook.com/navalenergy
“Two types of choices seem to me to have been crucial in tipping their outcomes towards success or failure: long-term planning, and willingness to reconsider core values.”

– Jared Diamond, Collapse: How Societies Choose to Fail or Succeed
Challenges

Navy

• Energy Efficient Acquisition
• Bounding C5I Energy
• Culture Change – A Spartan Ethos

National

• Fiscal Pressures & Balance of Payments
• Energy Storage
• Cost Effective Alternative Scale-up

![Graph showing US National Debt and Deficit](chart.png)
New Initiatives Afloat and Ashore

**Alternatives**
*Assure Mobility*

**Efficiency**
*Expand Tactical Reach & Lighten the Load*

**Afloat**
- Protect Critical Infrastructure
- Energy Conservation

**Ashore**
- Energy Security
National Fiscal Realities

- Excessive deficit will impact all sectors of government to reduce national debt, military will not be exempt
  - Fiscal pressures for reduced spending playing out during current budgetary standoff
  - Reduced tax revenue from long-term recession exacerbates deficit with increased spending to aid economic recovery
- Defense Department targeted as increased spending for 2 wars more than doubled overall defense spending in 10 years
- Coupled with budgetary pressures are consistent increases in energy prices for Navy due to heavy reliance on fossil fuel
CNO Energy Goals

50% Reduction in Shore Energy Use by 2020

15% Reduction in Tactical Energy Use by 2020
Greater diversity of energy sources in the future reduces risk of over-reliance on single sources of energy.
EO 13514 Energy Related GHG Emission Reductions

Tactical vehicles and ships are exempt from EO 13514 emission reduction targets.

Navy Energy Use
- Tactical: 73%
- Naval Facilities: 27%
- 34% Reduction by 2020
- 13.5% Reduction by 2020

FY 2010 Navy Total GHG Emissions
- Energy: 97.1%
- Other: 2.9%

SCOPE 1: Greenhouse gas emissions from sources that are owned or controlled by a Federal agency.
SCOPE 2: Greenhouse gas emissions resulting from the generation of electricity, heat, or steam purchased by a Federal agency.
SCOPE 3: Greenhouse gas emissions from sources not owned or directly controlled by a Federal agency but related to agency activities.
## Culture Change – Return to Our Roots

### Training and Education
- Mandate accession training for officers and enlisted that includes energy awareness as a core element

### Personnel Incentives
- Create Energy Subspecialty Codes for officers and enlisted

### Unit Incentives
- Energy efficiency, conservation, and leadership recognized at unit level afloat and ashore

### Energy Efficient Acquisition
- Incorporate energy in the Analysis of Alternatives

...A Spartan Warrior Ethos
## Culture Change – Sample Initiatives

### AFLOAT
- Development of Bridge Dashboard through ICAS
  - Provides actionable info for optimum system eff.
  - Focus on HVAC and gas turbine generators
  - Validate shore consumption in-port
- Portable Fuel Recovery / comp water treatment
  - Cost avoidance / eliminates waste stream
  - Payback after one use
  - Navy-wide application
- Expansion of Shipboard Energy Audits
- Efficiency Retrofits for Legacy Fleet

### ASHORE
- Real Time Building Metering
  - Provides actionable data for BEMs
  - Alternate solution until AMI is fully operational
- Building Energy Managers (BEM)
  - Energy audit included in Zone Inspection checklist
  - Participate in monthly Regional meetings
- Utilities Efficiencies
  - Increase efficiency to central Low Air Pressure syst.
  - Business Case Audits to identify efficiency opps.

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**Status:**
- Pilot completed at Pearl Harbor
- 15% energy savings potential identified

**Way Ahead:**
- Install remotely programmed t’sstats
- Train BEMs to use data
- Implement metering on additional buildings

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Fleet demonstrates a sea-shore integrated approach
Energy Efficient Acquisition

Considering Energy earlier and centering around AoA tradeoffs