



Department of the Navy's

# ENERGY PROGRAM

for Security and Independence





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# NAVAL ENERGY VISION, PRIORITIES, AND GOALS

## NAVAL ENERGY VISION

The Navy and Marine Corps will lead the Department of Defense (DoD) and the nation in bringing about improved energy security, energy independence, and a new energy economy.

The Secretary of the Navy (SECNAV) has set forth five energy goals to reduce Department of the Navy's (DON's) overall consumption of energy, decrease its reliance on petroleum, and significantly increase its use of alternative energy. Meeting these goals requires that the Navy and Marine Corps value energy as a critical resource across maritime, aviation, expeditionary, and shore missions. DON's Energy Program for Security and Independence will lead the Navy and Marine Corps efforts to improve operational effectiveness while increasing energy security and advancing energy independence. DON will achieve the SECNAV goals by adopting energy efficient acquisition practices, technologies, and operations.

## NAVAL ENERGY PRIORITIES FOR ENERGY REFORM

SECNAV has set two priorities for Naval energy reform: Energy Security and Energy Independence.

- ▶ **Energy Security** is achieved by utilizing sustainable sources that meet tactical, expeditionary, and shore operational requirements and force sustainment functions, and having the ability to protect and deliver sufficient energy to meet operational needs.
- ▶ **Energy Independence** is achieved when Naval forces rely only on energy resources that are not subject to intentional or accidental supply disruptions. As a priority, energy independence increases operational effectiveness by making Naval forces more energy self-sufficient and less dependent on vulnerable energy production and supply lines.

**Figure 1 The Secretary of the Navy's Energy Goals**

<p><b>1. Energy Efficient Acquisition</b></p>	<p>Evaluation of energy factors will be mandatory when awarding contracts for systems and buildings.</p>
<p><b>2. Sail the "Great Green Fleet"</b></p>	<p>DON will demonstrate a Green Strike Group in local operations by 2012 and sail it by 2016.</p>
<p><b>3. Reduce Non-Tactical Petroleum Use</b></p>	<p>By 2015, DON will reduce petroleum use in the commercial vehicle fleet by 50%.</p>
<p><b>4. Increase Alternative Energy Ashore</b></p>	<p>By 2020, DON will produce at least 50% of shore based energy requirements from alternative sources; 50% of DON installations will be net-zero.</p>
<p><b>5. Increase Alternative Energy Use DON-Wide</b></p>	<p>By 2020, 50% of total DON energy consumption will come from alternative sources.</p>

DON will increase its energy security and pursue energy independence by increasing its use of alternative energy, including biofuels, solar, wind, hydro, geothermal, and nuclear; and aggressively pursuing conservation, energy efficient technologies, and energy supply management innovations.

**SECRETARY OF THE NAVY'S ENERGY GOALS**

The President of the United States set forth a bold energy agenda that seeks to reduce the nation's dependence on fossil fuels, address the threat of global climate change, and create green jobs. At the same time, DON is subject to statutory mandates, executive orders, strategic guidance and DoD policy that regulate shore and tactical energy usage.

In support of the President's energy agenda, SECNAV committed the Navy and Marine Corps to meeting five energy goals listed in Figure 1.<sup>1</sup> These goals provide direction to the Navy and Marine Corps for achieving energy security and independence.



**PATUXENT RIVER, MD (April 22, 2010)** Secretary of the Navy (SECNAV) the Honorable Ray Mabus greets Navy pilots Lt. John Kollar and Lt. Cmdr. Tom Weaver following a showcase of a supersonic flight test of the "Green Hornet," conducted at Naval Air Station Patuxent River, MD. The F/A-18 Super Hornet strike fighter jet is powered by a 50/50 biofuel blend. The SECNAV has made research, development, and increased use of alternative fuels a priority for Department of the Navy. (U.S. Navy photo by Mass Communication Specialist 2nd Class Kevin S. O'Brien)

<sup>1</sup> Based on remarks from Secretary of the Navy's Energy Message to the Fleet, October 2009.



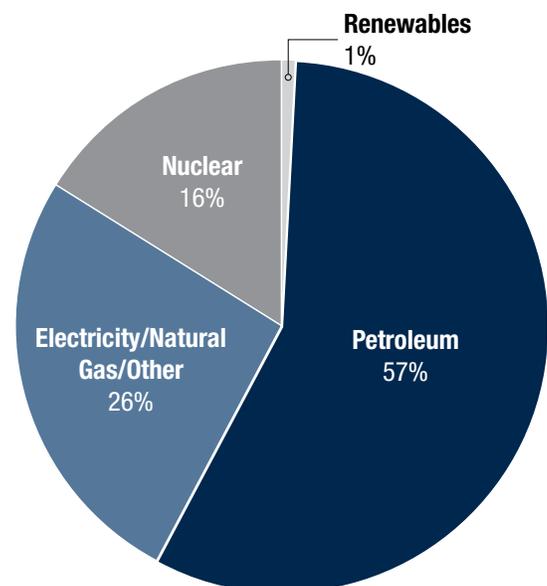
# WHERE DEPARTMENT OF THE NAVY IS NOW

Naval forces need energy to fuel tactical, expeditionary, and shore operations. Knowing how and where Navy and Marine Corps use energy today, establishes a baseline for measuring progress against the SECNAV goals, federal statutes, executive orders, and DoD policy.

## CURRENT STATE OF ENERGY UTILIZATION ACROSS DEPARTMENT OF THE NAVY

The SECNAV goals set forth an aggressive target to supply 50 percent of DON energy demand with alternative sources, such as solar, wind, biofuels, and geothermal energy by 2020. Figure 2 shows the breakdown of both shore and tactical Naval energy consumption by fuel source. Petroleum fuels are the primary energy source at 57 percent, followed by electricity, natural gas, and other sources<sup>2</sup> which account for 26 percent, and nuclear energy representing 16 percent. Renewable sources currently account for approximately 1 percent of overall DON energy sources.

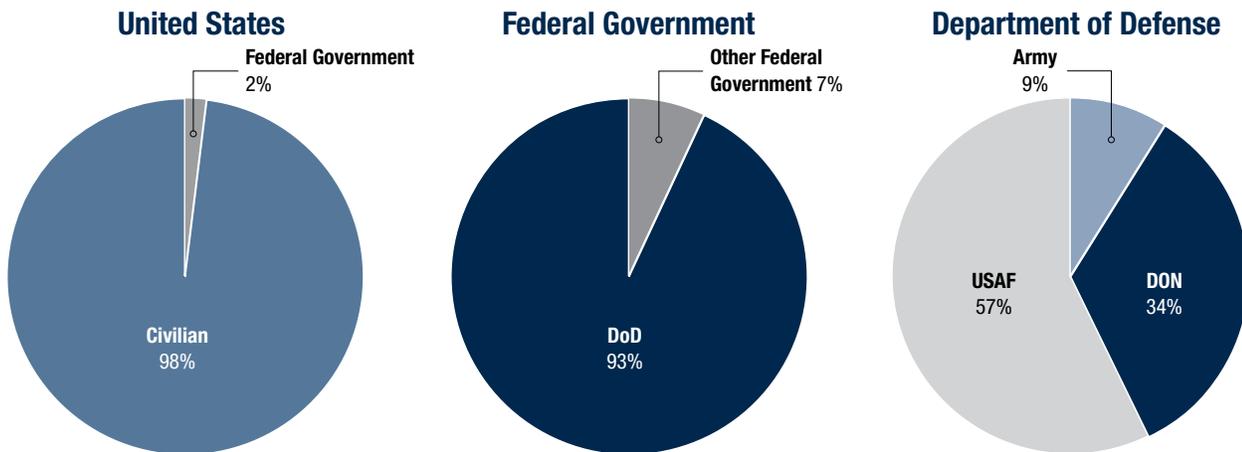
Figure 2 Naval Energy Consumption by Fuel Source (Shore and Tactical Combined), FY 2008<sup>1</sup>



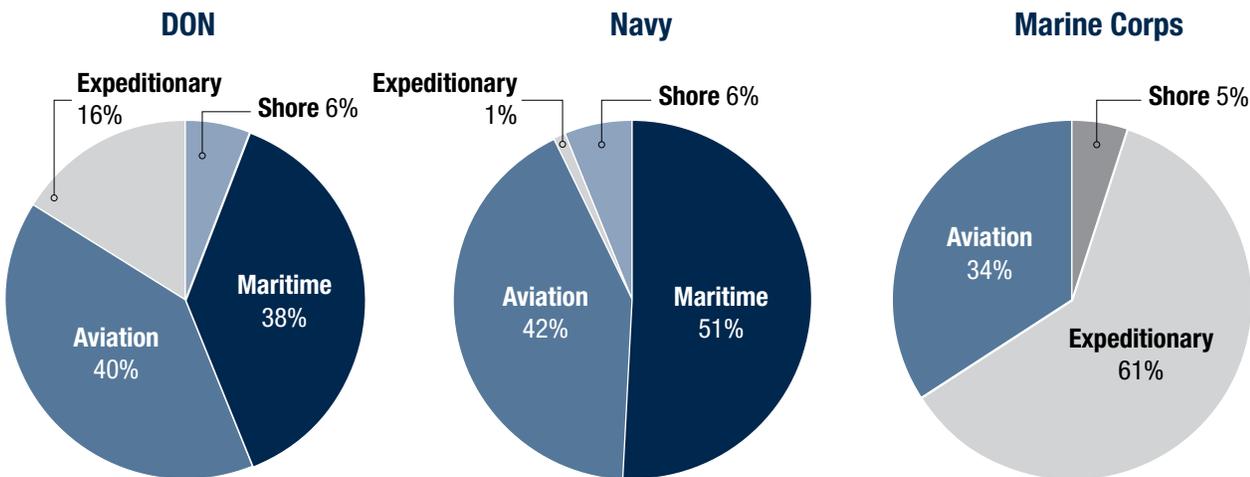
<sup>2</sup> Other sources include liquefied petroleum gas, propane, purchased steam, fuel oil, and coal.

<sup>3</sup> Source: Navy Energy Coordination Office

**Figure 3 Naval Petroleum Consumption—National and Department of Defense Context, FY 2008**



**Figure 4 Naval Petroleum Consumption Profile, FY 2008**



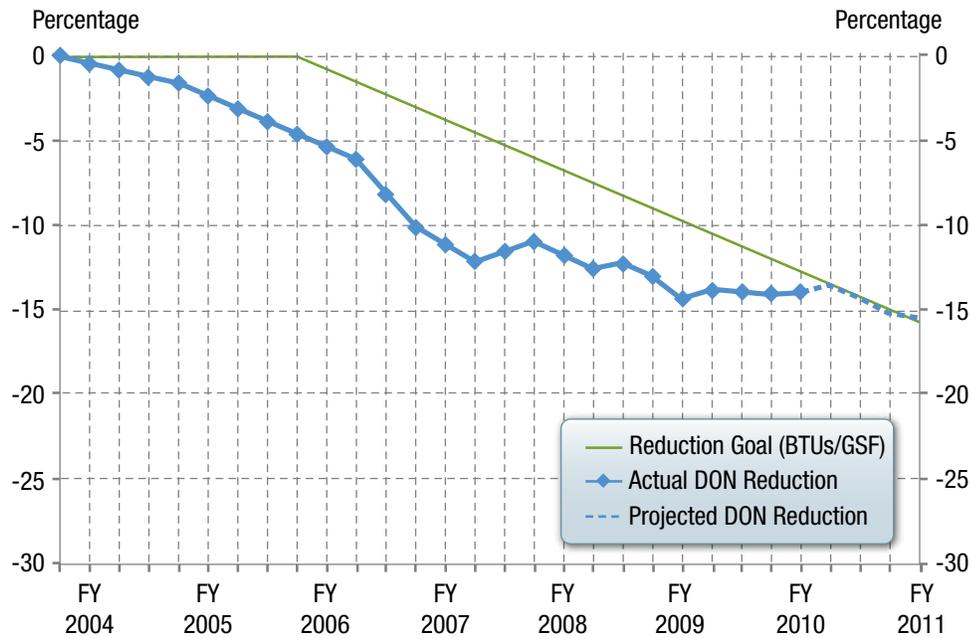
Three SECNAV goals focus on reducing Naval petroleum consumption:

- ▶ **Increase Alternative Energy Use Department-wide:** By 2020, 50 percent of DON total energy consumption, ashore and afloat, will come from alternative sources
- ▶ **Sail the “Great Green Fleet”:** By 2016, the Navy will sail the Great Green Fleet, a carrier strike group composed of nuclear ships, hybrid electric ships running on biofuel, and aircraft flying on biofuel
- ▶ **Reduce Non-Tactical Petroleum Use:** By 2015, DON will cut in half the amount of petroleum used in the commercial vehicle fleet through the phased adoption of hybrid, electric, and flex fuel vehicles

The United States consumes approximately 7.1 billion barrels of petroleum per year, or 25 percent of total world petroleum consumption. The DoD is by far the largest federal consumer, accounting for 93 percent of the total U.S. Federal Government petroleum use. Within DoD, DON accounts for 34 percent of total petroleum consumption, as compared to the Air Force (57 percent) and Army (9 percent). Figure 3 shows Naval petroleum consumption within the context of United States, DoD, and the U.S. Armed Forces.

Figure 4 shows DON, Navy, and Marine Corps petroleum consumption across maritime, aviation, expeditionary, and shore domains. Overall, maritime and aviation energy usage comprise 78 percent of Naval petroleum demand. Expeditionary operations account for approximately 16 percent, and shore operations 6 percent.

**Figure 5 Naval Facility Energy Intensity Reduction Trend**



**NAVAL PROGRESS IN REDUCING ENERGY CONSUMPTION**

Energy management is not new to the Navy and Marine Corps. Existing statutes and executive orders require reductions in facility energy intensity and greenhouse gas emissions while expanding the use of renewable and alternative sources of energy. Recent legislation and DoD policy set new requirements for managing operational energy. The SECNAV goals set forth an aggressive path that will put the Navy and Marine Corps out in front of these mandates.

DON’s progress towards meeting the facility energy intensity reduction goals can be seen in Figure 5. Facility energy intensity is down 30 percent from 1985 and 14 percent from the 2003 baseline. The Naval Energy Program will build on this progress with renewed focus on energy efficiency in shore facilities.



**NAVAL STATION GUANTANAMO BAY, CUBA (Mar. 29, 2005)**  
 At 80 meters (262 feet) high, the three-blade wind turbines are among the most noticeable features at Naval Station Guantanamo Bay, Cuba. (U.S. Navy photo by Kathleen T. Rhem)

## UTILIZATION OF ALTERNATIVE ENERGY SOURCES

Two of the SECNAV goals require adoption of alternative energy sources at shore facilities. In FY 2009, DON generated and consumed nearly 15,400 megawatt hours (MWh) of renewable electricity and 675,000 MMBtu of renewable thermal energy. Including all renewable energy sources (electric and thermal), 3.2 percent of Naval shore electrical energy consumption is sourced from renewable solutions.<sup>3</sup>

## DON TACTICAL AND SHORE ENERGY INITIATIVES

DON has undertaken many initiatives to improve energy efficiency, reduce overall energy usage, and harness alternative fuels and renewable energy sources. Hybrid electric drives and other technologies provide options for increased energy efficiency in current and future platforms. Migrating appropriate training to advanced aviation simulators reduces Naval aviation petroleum consumption, and specific aviation operational practices influence fuel burn rates. The Marine Corps is reducing the logistics burden associated with providing power to remote locations by utilizing solar-powered battery systems, which additionally have the potential to reduce fuel used to power generators. Expeditionary energy usage presents a unique set of challenges, which the Marine Corps' Expeditionary Energy Office (E2O) is aggressively working to solve. DON continues to explore how to integrate practical improvements to optimize efficiencies in operations.

Examples of some of the high-level near- and long-term actions that are either underway or planned by DON are shown in Table 1.



**Marine Corps Air Ground Combat Center Twentynine Palms (U.S. Marine Corps Photo, Jun 14, 2010)**

<sup>4</sup> This electrical energy consumption number (of 3.2 percent) does not include the renewable production from the geothermal power plant located at Naval Air Weapons Station China Lake, which produces 270 megawatts (MW) of generation capacity but is not directly consumed by Naval shore operations.

**Table 1 Recent and Planned Naval Energy Initiatives**

Focus Area		Near Term	Long Term
Tactical	Conservation and Efficiency	<ul style="list-style-type: none"> <li>▶ Modify platforms with proven technology</li> <li>▶ Expand i-ENCON for aircraft</li> <li>▶ Institute measurement and verification systems and protocol</li> <li>▶ Adopt operating practices that reduce energy usage</li> <li>▶ Increased simulator usage</li> <li>▶ Conduct shipboard energy audits</li> </ul>	<ul style="list-style-type: none"> <li>▶ Adopt alternative prime mover technologies and hull designs</li> <li>▶ Codify operating practices and train operators continuously</li> </ul>
	Alternatives	<ul style="list-style-type: none"> <li>▶ Certify aircraft and ship systems to operate on a 50/50 alternative fuel blend</li> <li>▶ Adopt commercial power solutions where feasible</li> <li>▶ Demonstrate emerging technologies at USMC Experimental Forward Operating Base</li> <li>▶ Expand the usage of Ground Renewable Expeditionary Energy Systems (GREENS) in the battlefield</li> </ul>	<ul style="list-style-type: none"> <li>▶ Integrate alternative fuels and concepts into new systems designs</li> <li>▶ Pursue Science &amp; Technology (S&amp;T) investments for cutting-edge technologies</li> </ul>
Shore	Conservation and Efficiency	<ul style="list-style-type: none"> <li>▶ Conduct facility energy audits</li> <li>▶ Adopt advanced metering and integrate with energy management systems</li> <li>▶ Pursue building recommissioning</li> <li>▶ Require at least LEED Silver certification for new construction and major renovations</li> <li>▶ Integrate Smart Grid enhancements</li> </ul>	<ul style="list-style-type: none"> <li>▶ Pursue Research, Development, Test and Evaluation (RDTE) on innovative energy technologies</li> <li>▶ Demonstrate and adopt innovative facility technologies</li> <li>▶ Work with industry to develop cutting-edge technologies</li> </ul>
	Alternatives	<ul style="list-style-type: none"> <li>▶ Develop necessary alternative fuel infrastructure</li> <li>▶ Aggressively adopt commercial solutions</li> <li>▶ Install wind, solar, biomass and explore geothermal</li> <li>▶ Rapidly deploy alternative-fueled vehicles</li> </ul>	<ul style="list-style-type: none"> <li>▶ Conduct RDTE on renewable power generating technologies</li> <li>▶ Conduct RDTE on next generation biofuels</li> </ul>



## SHORE AND TACTICAL ENERGY MANDATES

Recent legislation and executive orders have expanded mandatory energy reduction goals, broadening the focus from demand-side efficiencies to supply-side alternative and renewable energy development.

The SECNAV energy goals set the Navy and Marine Corps on a course to exceed these mandates and to lead DoD and the nation in adopting alternative energy sources and advanced energy efficient technologies. Appendix A summarizes key legislative and executive mandates for shore energy.

The need to manage operational energy demand from tactical and expeditionary systems is likewise recognized in recent legislation, high-level planning guidance, and DoD policy as highlighted in Appendix B. SECNAV's priorities of Energy Security and Independence align the Navy and Marine Corps with Congressional and DoD goals of reducing the operational risks posed by excessive platform energy demand and vulnerable energy supply lines.



**QUANTICO, VA (March 4, 2010)** A 300-watt photovoltaic battery system, developed by the Office of Naval Research, can provide continuous power to Marines in the field. The solar-powered battery, called the Ground Renewable Expeditionary Energy System (GREENS), is designed by the Advanced Power Generation Future Naval Capabilities program located at the Experimental Forward Operating Base at Marine Corps System Command Transportation Demonstration Support Area in Quantico, VA. *(U.S. Navy photo by John F. Williams)*



## SETTING DEPARTMENT OF THE NAVY'S ENERGY COURSE

Three major strategies underlie DON's Energy Program for Security and Independence: increasing the energy efficiency of tactical and shore systems; increasing the use of alternative energy; and steadfast environmental stewardship. These strategies contribute to the energy security of shore facilities; foster independence from petroleum fuel and its associated supply tail; and form the basis of the energy program.



**SAN DIEGO, CA** Solar photovoltaic power systems (SPVPS) installed at Naval Base San Diego (NBSD) are utilized to generate alternative energy to supply power to the base's buildings.

1. **Energy Efficiency.** Increased energy efficiency in maritime, aviation, and expeditionary systems increases the combat effectiveness of Naval forces by reducing the frequency of fuel re-supplies. Energy efficient shore facilities contribute to operational effectiveness by reducing the resources needed to sustain support operations. DON will develop and deploy new energy efficient technologies for tactical systems and adopt comprehensive energy efficient technologies, systems, and processes for its shore facilities.
2. **Alternative Energy.** Alternative energy is energy derived from non-petroleum sources. Increasing the use of alternative energy reduces our overall Naval dependence on petroleum, and mitigates the risks posed by vulnerable energy supplies for shore facilities. Alternative energy sources include, but are not limited to, wind, solar, geothermal, wave energy, tidal currents, nuclear energy, and biofuels derived from algae, camelina, and other feedstocks.

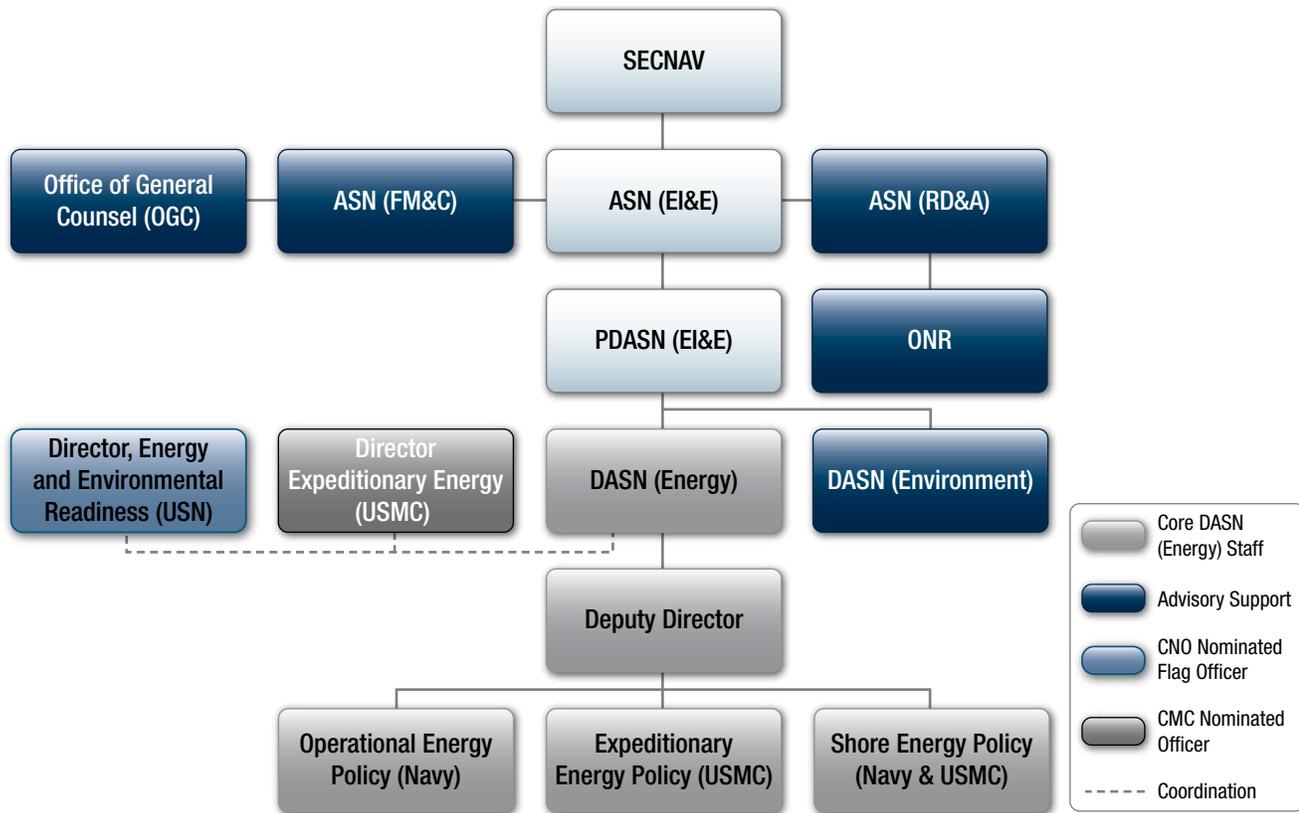
**3. Environmental Stewardship.** Environmental stewardship is the responsibility of all personnel. DON will reduce greenhouse gas emissions and other environmental impacts associated with Naval energy consumption by adopting conservation practices, incorporating sustainability into facility design, construction, operations and maintenance; and by actively managing its fuel use in tactical and expeditionary operations.

**STRATEGIC PROGRAM ELEMENTS**

Department of the Navy's Energy Program for Security and Independence is comprised of five strategic elements that will drive specific actions towards meeting the SECNAV goals. They are:

- ▶ Energy Efficient Acquisition
- ▶ Energy Management
- ▶ Science and Technology
- ▶ Behavioral Change
- ▶ Strategic Partnerships

**Figure 6 Naval Energy Governance and Reporting Structure**



## ENERGY EFFICIENT ACQUISITION

SECNAV is committing DON to transforming its requirements-setting, acquisition, and contracting processes to incorporate energy efficiency into decisions for new systems and buildings. DON will make energy a consideration in new contract awards and consider the overall energy footprint of contractors as part of the acquisition process. For tactical systems, the Navy and Marine Corps will incorporate the fully burdened cost of fuel (FBCF) methodology in determining life cycle energy costs, and set the energy demand of new systems with an operational energy Key Performance Parameter (eKPP) to optimize operational effectiveness and limit fuel logistics impacts. For buildings and energy consuming facilities, the life cycle energy costs will be a mandatory evaluation factor used when awarding contracts. When purchasing building equipment, office products, or any appliance or system, DON will purchase only products that meet the U.S. EPA's ENERGY STAR rating or Federal Energy Management Program (FEMP) designated products where available. DON will incorporate energy performance into the Preferred Supplier Program in order to make the energy footprint of a competing company an additional factor in acquisition decisions. These measures will produce lasting change by encouraging industry to take steps to produce Naval systems, buildings, and equipment in energy efficient ways.

## ENERGY MANAGEMENT

DON has established an energy management structure across the Naval enterprise. The structure sets forth formal governance roles and responsibilities, planning, programming, and budgeting for energy initiatives and provides a reporting structure for coordination between policy and implementing functions within DON.

### Governance

The organizational and reporting structure for energy management established within DON is shown in Figure 6 and includes major organizations having Naval energy responsibilities.

## Senior Naval Energy Official (ASN (EI&E))

The Assistant Secretary of the Navy for Energy, Installations, and Environment (ASN(EI&E)) is the senior Naval energy official, ultimately responsible for ensuring that DON energy goals and objectives are met.

### DASN Energy

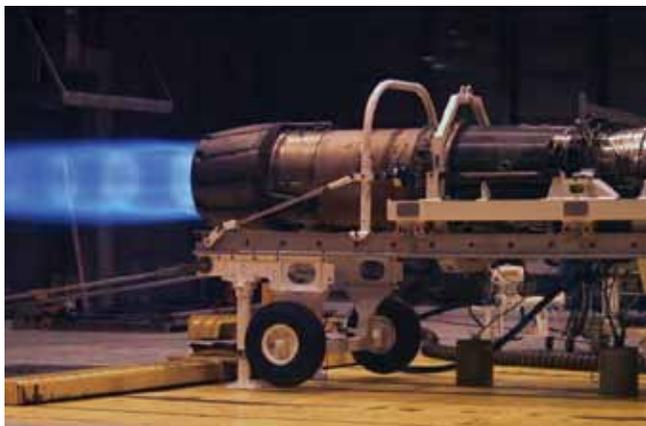
The Deputy Assistant Secretary of the Navy for Energy (DASN Energy) will lead the coordination of the Energy Program for Security and Independence under ASN (EI&E). DASN Energy is responsible for advocating for funding and resources for the necessary Navy and Marine Corps initiatives. DASN Energy is also responsible for developing Naval energy policy and guidance, to ensure that DON is in compliance with all statutory requirements, executive orders, and DoD Instructions for energy management. DASN Energy also coordinates with the Chief of Naval Operations and the Commandant of the Marine Corps to assist with planning, programming, budgeting, and executing programs to achieve SECNAV's energy goals. In addition, DASN Energy is responsible for initiating, coordinating, and managing a strategic communication plan, internally and externally, for DON's energy programs.

### DASN Environment

The Deputy Assistant Secretary of the Navy for Environment is responsible for all environmental matters that involve DON including environmental planning, natural resources conservation, cultural resources management, environmental quality, pollution prevention, and environmental restoration. These responsibilities include the environmental considerations of Naval shore, tactical, and expeditionary energy use. DASN Environment pursues a balanced approach to maintaining strong environmental stewardship that manages resources in support of the Navy and Marine Corps mission.

### ASN (RD&A)

The Assistant Secretary of the Navy for Research, Development, and Acquisition (ASN(RD&A)) ensures that DON RDT&E execution supports the energy goals of SECNAV, in coordination with DASN Energy. ASN(RD&A) is also responsible for developing program implementation guidance for the SECNAV's goals to make energy an evaluation factor in DON contracts.



**PATUXENT RIVER, MD** An F404 engine from an F/A-18 runs on biofuel in a Naval Air Systems Command test at the Aircraft Test and Evaluation Facility, Patuxent River, MD. (U.S. Navy photo by David Sckrabulis)

### Office of Naval Research (ONR)

The Office of Naval Research (ONR), under the direction of the Chief of Naval Research, plans, implements, executes, and promotes science and technology (S&T) programs for DON. The roadmap to support future forces and energy technology investments by ONR is the Naval Science and Technology Strategic Plan. ONR reports to SECNAV through ASN (RD&A) and is responsible for developing a portfolio of science and technology investments that equips DON to meet the SECNAV's goals, CNO Guidance and other applicable energy mandates.

### ASN (FM&C)

The Assistant Secretary of the Navy for Financial Management and Comptroller, ASN (FM&C), directs and manages the financial and budget activities required to successfully meet the SECNAV energy goals. ASN (FM&C) also provides advice and recommendations

to senior leadership on innovative financing tools and methods available for executing energy efficiency projects.



**SAN DIEGO, CA** The amphibious assault ship USS Makin Island (LHD 8) pulls into her homeport of San Diego. Makin Island is the final amphibious assault ship built in the Wasp-class, but the first of the class built with gas turbine engines and an electric drive. (U.S. Navy photo by Mass Communication Specialist 2nd Class Jon Husman)

### Navy Office of the General Counsel (OGC)

The Assistant General Counsel(Energy Installations & Environment) (AGC(EI&E)) is a senior legal advisor to the Navy General Office of the General Counsel (OGC) and is tasked by the General Counsel with providing legal counsel and support to ASN(EI&E)) and staff on all matters within the EI&E portfolio.



**PATUXENT RIVER, MD** An F/A-18F Super Hornet strike fighter, dubbed the "Green Hornet," conducts a supersonic test flight. The aircraft is fueled with a 50/50 blend of biofuel and conventional fuel. (U.S. Navy photo by Liz Goettee)

### Navy Energy Coordination Office (NECO)

The Navy Energy Coordination Office (NECO) is responsible for supporting energy efficiency, conservation, and alternative energy investments for Navy tactical (maritime, aviation, and expeditionary) and shore forces, developing a comprehensive Navy energy strategy, and coordinating with Naval Systems Commands to ensure programs are effectively implemented. NECO resides in the CNO's Energy and Environmental Readiness Division, under the Deputy Chief of Naval Operations for Fleet Readiness and Logistics (N4).<sup>4</sup>



**PORT HUENEME, CA** Navy Building 850 at Naval Base Ventura County (NBVC) incorporated energy efficient design elements, including skylights, open ceilings, exposed ventilation system ductwork, which maximizes the use of natural ventilation, and 100 percent daylighting. The building employs energy saving equipment, including energy efficient lighting and HVAC systems. Together, these features earned the building an outstanding ENERGY STAR® benchmarking score of 96.

### USMC Expeditionary Energy Office (E2O)

The USMC Expeditionary Energy Office (E2O) is responsible for analyzing, developing, and directing the Marine Corps' strategy to improve expeditionary capabilities across all warfighting functions. E2O identifies and requests resources to man, train, and equip the Marine Corps to meet the SECNAV goals, and all other energy mandates. E2O reports directly to the Assistant Commandant of the Marine Corps and serves

as the Commandant's principal advisor on expeditionary energy and resource matters.<sup>5</sup>



**TAN TAN, MOROCCO** Maj. Sean M. Sadlier (left) of the U.S. Marine Corps Expeditionary Energy Office explains the solar power element of the Expeditionary Forward Operating Base concept to Col. Anthony Fernandez during the testing phase of this sustainable energy initiative. The ExFOB is designed primarily for use by small Marine Corps units at forward operating bases in Afghanistan. Fernandez, a Marine Corps Reservist with a combined 28 years in the Corps, is the African Lion 2010 task force commander. (*U.S. Marine Corps photo by Maj. Paul Greenberg*)

### Planning, Programming, and Budgeting

Energy planning, programming, and budgeting occur at DON level, the component level, and the installation level. The overarching goal for DON's energy planning is to develop a portfolio of projects that enables DON to meet the SECNAV's energy goals, and comply with statutory mandates, executive orders, and DoD policy directives. DON will pursue innovative funding arrangements and financing mechanisms for energy projects to offset the high capital costs for energy high capital costs for alternative fuel and emerging energy technologies.

### SCIENCE AND TECHNOLOGY

Developing and employing advanced technologies are imperative in order to reach all of the SECNAV energy goals. Investments by ONR in energy science and technology foster partnerships with other Federal

<sup>4</sup> NECO activities are led by a CNO nominated flag officer titled "Director, Energy and Environmental Readiness (USN)" in Figure 6.

<sup>5</sup> E2O activities are led by a CMC nominated officer titled "Director, Expeditionary Energy (USMC)" in Figure 6.

agencies, universities, and laboratories; promote an innovative market and advance commercial capabilities to deliver energy efficiency; harness alternative energy; and foster environmental stewardship. The driving tenants for DON energy science and technology are:

- ▶ Accelerate adoption of nascent advanced technologies, especially for shore applications;
- ▶ Work with industry to mature and demonstrate new technologies for the near-term; and
- ▶ Aggressively research disruptive technologies for tactical applications that present unique Naval challenges

Investments in advanced technologies have the unique opportunity to utilize DON installations as test beds to measure and evaluate pilot studies of new systems and equipment.

### Maritime Technology Development

DON began laying the foundation for achieving long-term energy security by investing in the maritime development of state-of-the-art engines, complemented by enhanced training of a more energy-conscious force. The cornerstone for Naval tactical technology development is demonstrating the Great Green Fleet, a carrier strike group comprised of a carrier, one cruiser, two destroyers, a submarine and aircraft, all operating on alternative fuels. In other areas, Hybrid Electric Drive



**WASHINGTON, DC** A group photo of the winning commands in the Blue, Gold, and Platinum levels of the Secretary of the Navy Energy Awards. The SECNAV Energy Awards recognize commands that have made significant strides and contributions toward a greener, more energy-efficient Navy. (U.S. Navy photo by Mass Communication Specialist 2nd Class Elizabeth Vlahos)

(HED) technology will potentially improve efficiency by allowing ships to operate at slow speeds without running their main engines. Projects such as the Incentivized Energy Conservation Program (i-ENCON) and the Smart Voyage Planning software will allow the warfighter to consider energy in planning and employ innovative approaches to energy conservation. Looking to the future, DON will monitor and invest in next-generation biofuels and other long-term solutions.

### Aviation Technology Development

DON is pursuing alternative fuels, engine technology, and training tactics to reduce its use of petroleum in aviation—DON's biggest end use. In 2010, the Navy's Green Hornet, an F/A-18, was the first supersonic jet to operate on a biofuel blend. Success in developing an aviation biofuel is crucial to achieving the SECNAV's goals of reducing by half DON's energy consumption by 2020 and deploying the Great Green Fleet by 2016.

DON is also developing improvements to aircraft engines that reduce fuel consumption and other modifications that allow aircraft to fly farther on each tank of fuel. In addition, DON is identifying options for migrating to advanced simulators where appropriate to reduce fuel consumption during training.

### Expeditionary Technology Development

Cutting-edge tactical approaches to addressing energy efficiency provide the warfighter with enhanced mobility, effectiveness, and sustainability. Energy efficiency reduces the amount of fuel that convoys need to support Forward Operating Bases (FOBs), increases the operating radius, and reduces the overall expeditionary energy footprint. On-Board Vehicle Power provides exportable electric power generation capacity and can reduce the number of generators needed on the battlefield. Other expeditionary renewable and self-sustainable energy technologies that may be appropriate for DON to further develop, demonstrate or adopt to reduce expeditionary energy consumption include energy-generating backpacks, fuel cells, light emitting diode (LED) lighting, improved environmental controls, and portable solar panels.

## **Shore Technology Development**

DON has been a leader in developing alternative energy while providing secure energy to shore facilities. Technologies such as Ocean Thermal Energy Conversion (OTEC), wind, solar, wave energy, tidal currents, nuclear energy, biomass and geothermal power generation will be aggressively pursued to reach the SECNAV goal of producing 50 percent of shore-based energy from alternative sources by 2020. On the demand side, DoD signed a Memorandum of Understanding on Federal Leadership in High Performance and Sustainable Buildings, which calls for reducing energy demand in new facilities 30 percent beyond the ASHRAE Standard 90.1-2004 threshold, and employing sustainable design strategies that are life-cycle cost effective. To address requirements for the sustainable design of Navy and Marine Corps facilities, NAVFAC adopted the U.S. Green Building Council's Leadership in Energy & Environmental Design (LEED) Green Building Rating System. Incorporating LEED Silver design strategies into new construction offers increased opportunities for life cycle cost savings, fulfills DON's obligations under EPA Act 2005, E.O. 13423, and E.O. 13514, and promotes steadfast environmental stewardship.

## **Alternative Fuel Certification**

The operational use of alternative fuels by the Navy and Marine Corps will be hastened by collaborating with federal agencies and private industry involved with research, development, and certification of alternative fuels. Earth Day 2010 marked a significant milestone for DON, as the Navy conducted an aviation flight test of a 50/50 biofuel blend in supersonic operations. The Green Hornet flight is a critical milestone in DON's certification efforts, marking the beginning of efforts to expand the use of alternative fuels across Navy and Marine Corps tactical systems. The certification and testing of alternative fuels across Naval platforms will demonstrate DON's commitment to reducing dependence on fossil fuels and safeguarding the environment.

## **BEHAVIORAL CHANGE**

Communication and awareness are critical to achieving the SECNAV energy goals. DON will implement and maintain culture change initiatives, beginning with education and training, to ensure that energy management is understood by all personnel to be a priority in tactical, expeditionary, and shore missions. By linking the importance of energy security and energy efficiency to mission achievement, DON instills all personnel with an ethos of energy excellence. Energy awareness campaigns during April's Earth Day and October's Energy Awareness Month will be used to encourage personal actions that show commitment to energy program goals. Incentive programs enable the positive reinforcement of energy innovations in the market and lead to successful and sustainable energy project implementation. Metering will be linked to advanced monitoring and display technologies to provide feedback to users on their energy usage, integrating metering systems with behavioral change initiatives. Energy education and awards programs will maintain focus on attaining the SECNAV energy goals. DON will also explore new ways to encourage accountability by linking energy efficient behaviors to the performance assessment and advancement process.

## **Education and Training**

Energy management education and training will include all DON personnel. The goal of energy education and training is to instill a sense of personal accountability which results in sustained behavioral change. DON will conduct energy awareness training through online courses, professional certifications, trade associations, industry partners, and online and printed resources such as handbooks. Energy education and training will be tailored appropriately for personnel involved in operations, acquisitions, sustainment, and support functions. Individual actions will be encouraged and reinforced through strategic communication efforts that promote awareness through energy saving posters, tips, fact sheets, newsletters, seminars, energy working groups, and energy conferences.

## Awards and Incentives

Awards and incentives promote best practices in energy management across Naval operations. The two primary awards and recognition program for DON are the Federal Energy Management Program (FEMP) Energy Awards Program (for Renewable, Energy Efficiency, Energy Program Management, Water Conservation, and Exceptional Service), and the annual Presidential Awards. DON has also established the SECNAV Energy and Water Management Awards program to recognize installation, shipboard, and aviation energy accomplishments.

## STRATEGIC PARTNERSHIPS

DON will continue to cultivate strategic partnerships with existing and new organizations and leverage partner resources and capabilities (e.g. innovations, knowledge, and experience) in constructing and executing its energy program. The Army, Air Force, and other DoD organizations face energy challenges similar to those of the Navy and Marine Corps, and DON will continue to work with them. Many outside organizations have developed programs, tools, materials, and other resources that can be utilized by DON. Developing these strategic partnerships with federal agencies, state energy offices, regional energy and non-governmental organizations, energy service contractors, and equipment manufacturers and vendors is essential to the overall success of DON in meeting energy mandates and goals.

## Federal Agencies

Federal agencies outside of DoD are funding development of alternative energy resources and energy efficiency innovations, as well as supporting programs intended to raise the awareness of energy conservation practices. Agencies that DON is currently partnering with include:

- ▶ **Department of Energy (DOE)**—Working Groups include Smart Grid, Renewable Energy, Acquisitions, and Energy Efficiency.
- ▶ **U.S. Department of Agriculture (USDA)**—DON Memorandum of Understanding signed in January 2010 to encourage the development of advanced biofuels and other renewable energy systems.

## State Energy Offices

DON recognizes the important contributions offered by state energy offices. DON will pursue partnerships with state energy offices, explore incentives for renewable energy projects (through third parties), and leverage state funding for public awareness on energy. The primary candidates for state partnerships will be states with Renewable Energy Portfolio Standards (RPS), making third-party renewable energy projects attractive for DON shore installations.

## Regional Energy and Non-Governmental Organizations

Many regional energy and non-governmental organizations promote energy efficiency, energy awareness, and energy program management. DON will reach out to these organizations to learn and exchange energy awareness information, best practices, and other resources.

## Utility Service Providers

Utilities have access to public benefit program funding and often spend discretionary funds to promote renewable energy and energy efficiency projects. DON will pursue utility programs and partner with energy providers to leverage resources, funding, knowledge, and access innovative financing options. DON will also aggressively pursue load-shedding and demand response programs that promote energy conservation, distributed generation, and result in financial benefits to shore installations.

## **Industry and Trade Associations**

DON will need to rely on its industry suppliers for innovation and cooperation in meeting the SECNAV energy goals. Because of the expanse of Naval operations, the types of industry involved with this effort span virtually the entire manufacturing and service industrial base, and include:

- ▶ Ship and aircraft manufacturing and repair
- ▶ IT, communications, and electronics manufacturers
- ▶ Vehicle manufacturers
- ▶ Fuel developers and suppliers
- ▶ Builders and construction firms
- ▶ Energy service contractors
- ▶ Equipment manufacturers and vendors

DON will actively reach out to industry and trade associations, engineering societies, and other industry, trade and professional associations to contribute innovative solutions to Naval energy challenges. In addition, DON will continue to advance solutions stemming from Small Business Innovative Research to ensure emerging technologies are incorporated into DON energy management program.

## **Universities and Technical Centers of Excellence**

Much of the innovation that will be required to achieve the SECNAV's energy goals is currently being researched at public and private universities. DON will actively monitor university publications and technical conferences, and will rely on ASN (RD&A) and ONR to identify and recommend promising developments from the university sector. DON will continue to partner with universities to ensure cutting-edge research and emerging technologies are integrated into the Naval energy program.



## CHALLENGES

Achieving the SECNAV's ambitious energy goals presents challenges for the Navy and Marine Corps. Success depends on advancements within five broad categories: technology maturity, resource availability, alternative fuel availability, business process transformation, and data management.

### TECHNOLOGY MATURITY

Technology continues to mature and the ability of DON to leverage leading-edge technology and deploy it in tactical and shore arenas is critical. DON must be able to evaluate new systems and make the right decisions on which technologies to invest in while fully understanding the risks associated with using new approaches.

DON will continue to work with industry and other partners to build additional market pull to incentivize investments in alternative technologies, energy sources, fuels, and infrastructure.

### RESOURCE AVAILABILITY

Meeting the SECNAV's goals will require making difficult decisions to prioritize investments. In the current budget environment, DON has an opportunity develop solutions that leverage the financial resources of its government and industry partners. DON will need to work closely with its partners, exploring all appropriate

avenues to fund the investments necessary to meet the SECNAV's goals.

DON will also develop its human capital resources and invest wisely in cultivating skills that deliver energy excellence. This includes identifying the necessary competencies to manage energy across DON and train staff in the energy disciplines.

### ALTERNATIVE FUEL AVAILABILITY

Although Naval forces consume millions of barrels of petroleum products each year, DON is not a major market driver and therefore will need to partner with the commercial marketplace to grow a market where alternative fuel is available in sufficient quantities. Major players need to invest in alternative fuel production and infrastructure technologies—the demand for these fuels must come from the commercial marketplace as well as DON in order to spur investments and drive down costs. Moreover, Naval alternative fuels must be “drop in” replacements, able to mix with traditional petroleum

products with no adverse effects to the fuel quality or performance. DON will continue to test and certify equipment for compatibilities with alternative fuels derived from multiple feedstocks, ensure that alternative fuels utilized have lower lifecycle greenhouse gas emissions than conventional petroleum-based fuels, collaborate with industry and government partners to encourage market participation, and increase the amount of alternative fuel available to the commercial and DON markets.

### **BUSINESS PROCESS TRANSFORMATION**

DON will need to change many of its current business processes to enable transformation to meet its energy goals. This will include changing acquisition and contracting practices, operational methodologies, training routines, and installation energy management practices. Doctrine, policy, and clarifying guidance will be necessary to institutionalize behavioral change among every Sailor, Marine, and DON civilian employee.

### **DATA MANAGEMENT**

Data management is a critical element of transformation—DON needs to measure and monitor its energy usage, quantify its associated greenhouse gas emissions, and integrate this information with management dashboards and personnel awareness initiatives to inform end-users, managers, and decision-makers.



**Bremerton, WA (Jun. 8, 2002)** Wayne Weight, a shipyard worker from Paulsbo, WA, works on revamping the JP-5 fuel-overflow system on the aircraft carrier USS Carl Vinson (CVN 70). Carl Vinson is eliminating 34 of its 52 JP-5 fuel-overflow boxes and installing a more efficient pipe system. The remaining 18 overflow boxes are being replaced following an extensive deployment in support of Operation Enduring Freedom. *(U.S. Navy photo by Photographer's Mate Airman Ryan Jackson)*



## MOVING FORWARD

Department of the Navy's Energy Program for Security and Independence will drive the Navy and Marine Corps towards achievement of the SECNAV's energy goals while complying with legislative mandates and executive orders.

The SECNAV goals establish a commitment by the DON to significantly reduce energy usage and increase its use of alternative energy, in tactical, shore, and expeditionary operations, by:

- ▶ Including energy as an evaluation factor when awarding new contracts for systems and buildings;
- ▶ Demonstrating a Green Strike Group in local operations by 2012, and sailing it by 2016;
- ▶ Reducing petroleum use in its commercial vehicle fleet by 50 percent by 2015;
- ▶ Deriving at least 50 percent of its shore energy requirements from alternative sources, and making 50 percent of its installations net-zero by 2020; and
- ▶ Securing 50 percent of total energy demand from alternative sources by 2020.

Achieving these goals will result in greater energy security, reduced petroleum fuel dependence, and mitigation of greenhouse gas emissions during Naval operations. Moreover, aggressive energy policy and leadership will improve the combat and operational effectiveness of Naval forces by reducing the risks from fuel delivery, increasing the efficiency of tactical systems, and making Naval installations less reliant on vulnerable



**ARABIAN SEA (May 20, 2010)** The Nimitz-class aircraft carrier USS Dwight D. Eisenhower (CVN 69) and the guided-missile destroyer USS Farragut (DDG 99) pull along both sides of the Military Sealift Command fast combat support ship USNS Supply (T-AOE 6) for a replenishment at sea. Dwight D. Eisenhower and Farragut are part of the Eisenhower Carrier Strike Group and are deployed as part of an ongoing rotation of forward-deployed forces to support maritime security operations in the U.S. 5th Fleet area of responsibility. *(U.S. Navy photo by Naval Air Crewman 3rd Class Ruben N. Coss/Released)*

energy supplies. DON will engender an ethos whereby all personnel are stewards committed to sustainable energy management practices, and who value the efficient use of clean and secure energy.

# APPENDIX A: SHORE ENERGY MANDATES

Focus Area	Statute/ Executive Order	Provisions
<b>Acquisition of Alternative Fuels and Energy Efficient Products</b>	Executive Order 13514 October 2009	<ul style="list-style-type: none"> <li>▶ Advance sustainable acquisition to ensure that 95 percent of new contract actions including task and delivery orders, for products and services with the exception of acquisition of weapon systems, are energy-efficient (Energy Star or Federal Energy Management Program (FEMP) designated), water-efficient, biobased, environmentally preferable (e.g., Electronic Product Environmental Assessment Tool (EPEAT) certified), non-ozone depleting, contain recycled content, or are non-toxic or less-toxic alternatives, where such products and services meet agency performance requirements</li> </ul>
	Energy Independence and Security Act of 2007	<ul style="list-style-type: none"> <li>▶ To meet the requirements of an agency for an energy consuming product in a product category covered by the Energy Star program or the Federal Energy Management Program (FEMP) for designated products, the head of the agency shall procure an Energy Star product or a FEMP designated product</li> <li>▶ No Federal agency shall enter into a contract for procurement of an alternative or synthetic fuel, including a fuel produced from nonconventional petroleum sources, for any mobility-related use, other than for research or testing, unless the contract specifies that the lifecycle greenhouse gas emissions associated with the production and combustion of the fuel supplied under the contract must, on an ongoing basis, be less than or equal to such emissions from the equivalent conventional fuel produced from conventional petroleum sources</li> </ul>
<b>Energy Efficiency and Energy Consumption</b>	Executive Order 13514 October 2009	<p>Implement high performance sustainable Federal building design, construction, operation and management, maintenance, and deconstruction including:</p> <ul style="list-style-type: none"> <li>▶ Beginning in 2020, ensure new buildings are designed to achieve zero-net-energy by 2030</li> <li>▶ Ensure that at least 15 percent of existing buildings and building leases (&gt; 5,000 gross square feet) meet the Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings by FY 2015</li> </ul>
	Energy Independence and Security Act of 2007	<ul style="list-style-type: none"> <li>▶ Reduce energy intensity in federal buildings 3 percent annually and 30 percent by 2015 from a FY2003 baseline</li> <li>▶ Not later than October 1, 2016, each agency shall provide for equivalent metering of natural gas and steam</li> </ul>
	Executive Order 13423 January 2007	<ul style="list-style-type: none"> <li>▶ Improve energy efficiency through reduction of facility energy intensity 3 percent annually and 30 percent by end of FY2015 from a FY2003 baseline</li> </ul>
	Energy Policy Act of 2005	<ul style="list-style-type: none"> <li>▶ By October 1, 2012, all Federal buildings shall, for the purposes of efficient use of energy and reduction in the cost of electricity used in such buildings, be metered</li> </ul>

Focus Area	Statute/ Executive Order	Provisions
<b>Greenhouse Gas Emissions Reduction</b>	Executive Order 13514 October 2009	<ul style="list-style-type: none"> <li>▶ Each agency shall establish and report a comprehensive inventory of absolute greenhouse gas emissions, including scope 1, scope 2, and specified scope 3 emissions</li> <li>▶ Establish and report a percentage reduction target for agency-wide reductions of scope 1, 2, and 3 greenhouse gas emissions in absolute terms by FY2020, relative to a FY2008 baseline of the agency's scope 1, 2, and 3 greenhouse gas emissions</li> </ul>
<b>Renewable Energy</b>	National Defense Authorization Act (NDAA 2010)	<ul style="list-style-type: none"> <li>▶ Produce or procure <math>\geq 25</math> percent of the total quantity of facility electricity from renewable energy sources beginning in 2025 (NDAA 2010)</li> </ul>
	Energy Policy Act of 2005	Renewable energy purchase requirement: <ul style="list-style-type: none"> <li>▶ <math>\geq 3</math> percent for FY2007-FY2009,</li> <li>▶ <math>\geq 5</math> percent for FY2010-FY2012,</li> <li>▶ <math>\geq 7.5</math> percent for FY2013 and each fiscal year thereafter</li> </ul>
	Executive Order 13423 January 2007	<ul style="list-style-type: none"> <li>▶ Consume <math>\geq 50</math> percent of renewable energy from new (in service after January 1, 1999) renewable sources</li> <li>▶ Implement renewable energy generation projects on agency property for agency use</li> </ul>
<b>Vehicle Petroleum Consumption</b>	Executive Order 13514 October 2009	Reduce the use of fossil fuels by: <ul style="list-style-type: none"> <li>▶ Using low greenhouse gas emitting vehicles in the agency fleet;</li> <li>▶ Optimizing the number of vehicles in the agency fleet;</li> <li>▶ Reducing the agency fleet's total consumption of petroleum products by a minimum of 2 percent annually through the end of FY2020, relative to baseline FY2005</li> </ul>
	Energy Independence and Security Act of 2007	Beginning in FY2010, each Federal agency shall reduce petroleum consumption and increase alternative fuel consumption to meet the following goals: <ul style="list-style-type: none"> <li>▶ No later than Oct. 1, 2015, and for each year thereafter, each Federal agency shall achieve <math>\geq 20</math> percent reduction in annual petroleum consumption and a 10 percent increase in annual alternative fuel consumption, relative to FY2005 baseline</li> <li>▶ Alternative fuels cannot be purchased if lifecycle greenhouse gas emissions are greater than emissions from conventional petroleum sources</li> </ul>
	Executive Order 13423 January 2007	<ul style="list-style-type: none"> <li>▶ Increase the total fuel consumption that is non-petroleum-based by 10 percent annually;</li> <li>▶ Use plug-in hybrid (PIH) vehicles when PIH vehicles are commercially available at a cost reasonable comparable, on the basis of life-cycle cost, to non-PIH vehicles</li> </ul>

# APPENDIX B: TACTICAL ENERGY MANDATES

Statute/Guidance	Provisions
<b>2010 Quadrennial Defense Review (QDR)</b>	<ul style="list-style-type: none"> <li>▶ Asserts that DoD will fully implement the Energy Efficiency KPP and fully burdened cost of fuel (FBCF) methodologies required by the NDAA 2009</li> </ul>
<b>National Defense Authorization Act of 2009 (NDAA 2009)</b>	<ul style="list-style-type: none"> <li>▶ Requires analyses and force planning processes to consider the requirements for, and vulnerability of, fuel logistics</li> <li>▶ Requires a fuel efficiency Key Performance Parameter (KPP) in the requirements development process, for modification of existing or development of new fuel-consuming systems</li> <li>▶ Requires that life-cycle cost analysis for new systems include calculation of the fully burdened cost of fuel (FBCF) during Analysis of Alternatives (AoAs), and evaluation of alternatives in acquisition program design trades</li> </ul>
<b>National Defense Authorization Act of 2007 (NDAA 2007)</b>	<ul style="list-style-type: none"> <li>▶ It shall be the policy of the Department of Defense to improve the fuel efficiency of weapons platforms, consistent with mission requirements, in order to:               <ol style="list-style-type: none"> <li>1. enhance platform performance;</li> <li>2. reduce the size of the fuel logistics systems;</li> <li>3. reduce the burden high fuel consumption places on agility;</li> <li>4. reduce operating costs; and</li> <li>5. dampen the financial impact of volatile oil prices</li> </ol> </li> <li>▶ The Secretary of Defense shall conduct a study to examine the feasibility of using solar and wind energy to provide electricity for expeditionary forces</li> </ul>
<b>DoD Instruction 5000.02: Operation of the Defense Acquisition System (December 2008)</b>	<ul style="list-style-type: none"> <li>▶ Directs that AoAs assess alternative ways to improve energy efficiency</li> </ul>
<b>Manual for Operation of the Joint Capabilities Integration &amp; Development System: CJCSI 3170.01G (February 2009)</b>	<ul style="list-style-type: none"> <li>▶ Establishes Energy Efficiency as a new, selectively-applied KPP</li> </ul>





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