

Fiscal Year 2015 Operational Energy Annual Report



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For Open Publication

AUG 15 2016 11

Office of Security Review
Department of Defense

August 2016

Office of the Under Secretary of Defense for Acquisition,
Technology, and Logistics

The estimated cost of this report or study for the Department of Defense is approximately \$43,000 in Fiscal Years 2015-2016. This includes \$28,000 in expenses and \$15,000 in DoD labor.

Cost estimate generated on December 4, 2015. RefID: 2-7034F9F

16-C0844

Introduction

This report fulfills the Department of Defense Operational Energy Annual Report requirement in section 2925(b) of title 10, United States Code, for FY 2015. The report includes information on operational energy demands, progress in implementing the *Operational Energy Strategy*, investments in alternative fuels, and support to contingency operations. By statute, operational energy is defined as “energy required for training, moving, and sustaining military forces and weapons platforms for military operations,” and it includes energy used by ships, aircraft, combat vehicles, and tactical power generators.

Throughout FY 2015, the Department:

- Incorporated operational energy in policy and doctrine;
- Supported operational energy innovation in current operations; and
- Integrated operational energy considerations into the future force

In FY 2015, the Department consumed over 88 million barrels of fuel to power ships, aircraft, combat vehicles, and contingency bases. To minimize the risks associated with moving fuel over long distances, the Department purchases fuel close to the point of use. As a result, over 50 percent of fuel was purchased outside of the United States in FY 2015. Driven by a combination of operational tempo and the initiatives addressed in this report, the Department estimates it will use slightly fewer barrels of fuel in FY 2016 than in the previous fiscal year. For instance, improved medium generators are consuming 21 percent less fuel than their predecessors, Hybrid Electric Drive propulsion systems are providing new amphibious ships with 2.5 more days on station days between refuelings when used 50 percent of the time, and improved routing and cargo loading for airlift aircraft mean less fuel is needed to sustain global operations.

In FY 2015, the Department revised the 2011 *Operational Energy Strategy* to account for strategic guidance, the evolving operational environment and experience from the battlefield. The updated 2016 *Operational Energy Strategy* reaffirms the crucial role of operational energy in enabling our forces to perform worldwide missions; assesses changes in strategic direction and the operational environment; and establishes revised objectives for increasing future capabilities, identifying and reducing risk, and enhancing current mission effectiveness.¹

These objectives are directed toward meeting broader Department guidance. In particular, the 2012 *Defense Strategic Guidance* calls for the Department to “rebalance toward the Asia-Pacific region.”² The 2014 *Quadrennial Defense Review* reinforced this direction and

¹ This document is available at http://www.acq.osd.mil/eie/Downloads/OE/2016%20OE%20Strategy_WEBd.pdf

² This document is available at http://www.defense.gov/news/Defense_Strategic_Guidance.pdf.

noted that the Department will “retain and strengthen our power projection capabilities so that we can deter conflict, and if deterrence fails, win decisively against aggressors.”³ In 2015, *The National Military Strategy* (NMS) confirmed that the Department will “press forward with the rebalance to the Asia-Pacific region, placing our most advanced capabilities and greater capacity in that vital theater.”⁴ However, the United States still retains enduring interests throughout the globe, and the NMS directs the Department to continue to provide a full range of military options for addressing both revisionist states and violent extremist organizations.

In this operational environment, the Department needs to assure the delivery of energy across a range of threats. For instance, the difficulty of moving energy across the last tactical mile of resupply in the face of improvised explosive devices, irregular adversaries, and insurgent attacks will remain a part of the operational environment. Likewise, our ability to project and sustain power worldwide will be challenged by anti-access, area-denial (A2/AD) weapons able to target our combat and logistics forces and infrastructure with long-range precision. Together, A2/AD threats, hybrid adversaries, and the tyranny of distance mean a greater risk to assured delivery of operational energy.

These factors led to a revised 2016 *Operational Energy Strategy* that will:

- Increase future warfighting capability by including energy throughout force development.
- Identify and reduce logistics and operational risks from operational energy vulnerabilities.
- Enhance mission effectiveness of the current force through updated equipment and improvements in training, exercises, and operations.

Moving forward, the Department will use these objectives to frame the institutionalization of operational energy throughout our organizations and processes, the conduct of current operations, and the development of future capabilities.

Adapting Policy and Doctrine.

Throughout FY 2015, the Department made steady progress integrating operational energy considerations into decision-making and business processes. Along with updating the *Operational Energy Strategy*, the Department refined and applied the energy Key Performance Parameter (eKPP) in capabilities development; included operational energy considerations in the *Manual for the Operation of the Joint Capabilities Integration and Development System*

³ This document is available at http://archive.defense.gov/pubs/2014_Quadrennial_Defense_Review.pdf

⁴ This document is available at

http://www.jcs.mil/Portals/36/Documents/Publications/2015_National_Military_Strategy.pdf

(*JCIDS*), *Joint Concept for Logistics*, and alternative fuels policy; adapted oversight of operational energy investments; and implemented a range of Service-specific changes to policy and training associated with operational energy.

The Department addresses operational energy throughout its procurement process, with particular attention given to planning and concept development in an effort to shape preliminary weapons system design. In February 2015, the *JCIDS Manual* was updated with additional information on the energy supportability analysis (ESA) used to develop the eKPP for all new systems.⁵ Along with growing fuel and electrical power demands across the Joint force, improved adversary capabilities mean constraints on energy logistics must be included in the analysis for any new system that demands energy in operations. The ESA informs system attributes for developmental and pre-productions systems. For systems that are nearing or post production, the ESA ensures logistics risks have been accounted for the Services and, if necessary, mitigation strategies (such as changing the Concept of Operations; tactics, techniques, and procedures; force structure/composition of a unit; or even changes to the platform) are identified. From this analysis, a measurable and testable eKPP is developed to ensure the system's predicted energy demand is met.

In FY 2015, the Chairman of the Joint Chiefs of Staff also updated the *Joint Concept for Logistics*.⁶ In addition to introducing Globally Integrated Logistics as a way to meet logistical challenges in support of *Joint Force 2020*, the concept recognized the operational challenges posed by increasing operational energy demands and endorsed changes in operational planning and force development to mitigate these risks.

The Department continued to integrate operational energy in policy, issuances, and guidance throughout the year. In June 2015, the Department published DoD Instruction 4140.25, "DoD Management Policy for Energy Commodities and Related Services," formalizing DoD's policy priorities with respect to procuring, testing, and evaluating "drop-in" alternative fuels for operational purposes.⁷ The Department also included operational energy language in the draft DoD Instruction for Global Defense Posture, ensured Theater Posture Plans addressed operational energy, and captured best practices for inclusion in the Chairman's Training Guidance.

Title 10, U.S.C., section 2926, directs that the Assistant Secretary of Defense for Energy, Installations, and Environment (ASD(EI&E)) review the President's Budget and certify whether the level of funding for operational energy initiatives is adequate for carrying out the Department's *Operational Energy Strategy*. Throughout FY 2015, the Department improved the

⁵ This document is available at https://dap.dau.mil/policy/Documents/2015/CJCSI_3170_011.pdf

⁶ This document is available at https://jdeis.js.mil/jdeis/jel/concepts/concept_logistics.pdf

⁷ This document is available at www.dtic.mil/whs/directives/corres/pdf/414025p.pdf

methodology and approach to budget certification and streamlined the process in order to meet statutory deadlines. Operational energy investments are part of ASD(EI&E)'s routine processes for oversight of the development of Service Program Objective Memoranda and budgets. OASD(EI&E), the Services, and the Defense Logistics Agency–Energy (DLA-E) also met at the Deputy Assistant Secretary-level to review investments in more detail, and they agreed on a common framework for categorizing FY 2017 President's Budget investments and aligning these investments to the objectives in the new strategy. Concurrent to these regular discussions with the Services on the FY 2017 budget, the ASD(EI&E) certified the FY 2016 budget as adequate. The improved process enhances the Services' budget submissions, assists with prioritization, and ensures a more timely and relevant certification of operational energy investments in the President's Budget.

Co-chaired by the ASD(EI&E) and the Joint Staff Director for Logistics, the Defense Operational Energy Board (DOEB) met twice in 2015 and served as one of the primary mechanisms for coordinating and reviewing Department initiatives. The DOEB reviewed Service and DLA Energy wargames, assessed results, and made recommendations for future iterations. The DOEB also reviewed the objectives and targets of the Department's 2016 *Operational Energy Strategy* in light of lessons learned and improved the discussion by inviting the Combatant Commands to participate as well. The DOEB will continue to meet on a semi-annual basis to provide oversight and coordination for operational energy initiatives across the Department.

The Department also continued to showcase the intent and progress being made in operational energy. The ASD(EI&E) highlighted information on a technology demonstration at the National Defense University, a request for proposal for cost effective ways to reduce drag on aircraft, and an infographic describing the role of energy innovation in global operations. The ASD(EI&E) also sponsored a Joint panel presentation on historical perspectives of operational energy.

The individual Services also made significant progress integrating operational energy into training and decision-making for Soldiers, Sailors, Airmen, and Marines, including:

- Army. In May, the Army issued the Energy Security and Sustainability Strategy.⁸ The strategy recognizes that maintaining the Army's tactical and strategic edge heavily depends upon the wise use of resources (energy, water, and land) to preserve future choices. The strategy also describes an evolution from viewing resources as a constraint on operational effectiveness to a perspective that considers the critical role of energy, water, and land resources as mission enablers.

⁸ This document is available at: <http://www.army.mil/e2/c/downloads/394128.pdf>

- Marine Corps. In March, the Marine Corps released an Administrative Message about the Energy Ethos Campaign.⁹ In the message, the Marine Deputy Commandant for Installations and Logistics directed the establishment of unit energy managers, mandatory energy training, and the adoption of energy saving measures. In addition, the Marine Corps issued a Request for Information in support of the Expeditionary Energy Concepts at Camp Lejeune, North Carolina, in June of 2015.¹⁰ The concept demonstration for 2015 focused on hybrid/electric all-terrain vehicles, advanced batteries and energy storage technologies, and Fuel cells up to 10 Kilowatts.
- Navy. In July, the Navy issued a comprehensive strategy to institutionalize energy learning opportunities into the officer and enlisted training and education continuum.¹¹ This document includes recommendations for the development of new learning opportunities in energy efficiency, conservation, and the relationship these two measures have with increasing combat capability. In FY 2015, the Navy developed a web-based Energy General Military Training, which was made available to military staff beginning in October 2015. The Naval Postgraduate School also continued to conduct the “Leading Innovation-Energy Application Focus” course for Navy Flag Officers and Senior Executive Service personnel. In addition to these training and education efforts, the Navy successfully deployed the second phase of the “Energy Warrior” digital mobile application, a key component of the Navy’s culture change initiative to change mindsets about energy as a combat enabler.¹² The Navy continues to use the quarterly magazine, *Currents*, to educate stakeholders on the Navy energy program, specific initiatives, and successes. Finally, to further institutionalize consideration of energy in capabilities development, the Navy issued a guidance memorandum for the implementation of the eKPP and the associated energy supportability analysis for new systems.
- Air Force. In keeping with one of the four tenets of the Air Forces’ energy strategic plan, fostering an energy aware culture, the “Airman Powered by Innovation” program simplifies the process for submitting ideas, making it easier for Airmen at the lowest levels to affect change across the Air Force. Airmen are using this program to develop innovative solutions to Air Force energy challenges. In FY 2015, the Air Force also

⁹ This document is available at:

<http://www.marines.mil/News/Messages/MessagesDisplay/tabid/13286/Article/173289/energy-ethos-campaign-and-unit-energy-manager-uem-program.aspx>

¹⁰ This document is available at:

http://www.hqmc.marines.mil/Portals/160/Docs/E2C%202015%20RFI_FINAL.pdf

¹¹ Document available online at:

<http://greenfleet.dodlive.mil/files/2015/07/20150702-Navy-Energy-TE-Plan-FINAL-VERSION.pdf>

¹² More information available online at: <http://greenfleet.dodlive.mil/energy/energywarrior/>

sustained efforts to leverage commercial industry best practices to achieve fuel savings through behavioral change, and it expects to integrate these efforts across the enterprise. In addition, the Air Force focused three simulator sessions for T-1 Undergraduate Pilot Training, emphasizing optimal altitude and airspeed selection, efficient descent techniques, and fuel loading guidelines. These help to instill an “energy aware” culture in future C-17, C-5, and KC-135 pilots. Finally in September, as part of the annual Air Force Conference, an operational energy panel hosted a discussion on technology investments, trainer/training improvements, behavior adjustments, and operational efforts, which were all aimed at getting the most fight from energy resources.

Supporting Current Operations

Since 2010, the Department has actively made energy improvements to current operations around the globe. Through initiatives like Operation Dynamo, which right-sized electrical power requirements in deployed locations and advanced capabilities of deployed forces, the Department has helped Warfighters answer tough energy questions. These efforts have reduced energy reliability problems at a number of remote bases and provided additional operational capability to commanders. Building on success in the Middle East, we are applying lessons learned to extend the operational reach of Warfighters on air, land, and sea in the Asia-Pacific region and other Combatant Command areas of operation.

During the last year, we have assisted Combatant Command energy advisors in shaping policy and strategic guidance to achieve Department-wide energy goals. Understanding the need to train as we fight, the Department is working to inject operational energy into exercises and training to validate and refine relevant tactics, techniques, and procedures, and to share this knowledge across the Department and with partner nations. To bolster security cooperation, the Department now includes operational energy activities in the Defense Environmental International Cooperation program to give the Combatant Commands another method to build partner capacity and foster good will. The OASD(EI&E) has partnered with the Services and Combatant Commands to look at energy challenges in strategic areas of the globe and is working to address challenging problems in the air, land, and sea domains.

Throughout U.S. Central Command (USCENTCOM), Department activities included:

- **Iraq.** In support of Operation Inherent Resolve, the Program Manager for Expeditionary Energy and Sustainment Systems (PM E2S2) deployed 20 soft wall and 2 rigid wall Force Provider modules to support approximately 3,300 personnel. The PM E2S2 also supported forces with energy efficient generators, power distribution equipment, and environmental control units, and continues to support operations with set-up, maintenance, training support, and detailed power planning.

- Kuwait Energy Efficiency Program. In conjunction with U.S. Army Central, the ASD(EI&E) supported the deployment and testing of energy efficient shelter systems at Camps Arifjan and Redleg to serve as a proof-of-concept for advanced shelter designs.

In support of U.S. Africa Command (USAFRICOM), the Department improved energy use at multiple sites, including:

- Support to Operation United Assistance in Liberia and Senegal, West Africa. PM E2S2 deployed and sustained 25 Force Provider modules, providing energy efficient base operation support to approximately 3,450 personnel.
- U.S. Air Force Africa Site in Agadez, Niger. Building on successes achieved at Niamey, Niger, the Department brought together a coalition of partners and multiple planning tools to develop a master planning tool for contingency bases.

Moving to the Western hemisphere, the Department activities included:

- U.S. Army Alaska (USARAK) Soldier Enhancement Program, Alaska. The Department continued to evaluate improved arctic tents and cargo sleds in support of USARAK's expanding mission in the Arctic. Through partnerships with industry and Department of Energy (DOE) national laboratories, the Department continues to explore equipment sets and advanced power generation techniques to provide additional capability to forces in the Arctic. Test and evaluation are scheduled to continue through the winter of 2015.
- Twentynine Palms Marine Corps Air Ground Combat Center, California. Exercise results provided the 1st Marine Expeditionary Brigade command element with real-time visibility of power production and generator performance, enabling the optimization of cantonment power production for the Brigade Headquarters Group. In addition, the Marine Corps identified behavior changes that resulted in significantly improved fuel management and increased operational reach. They also documented how metering and monitoring informs behavior of both individuals and units. As a result of these successes, the ASD(EI&E) partnered with the Marine Corps to study the broader effects of behavior change on battlefield energy use, with results expected in FY 2016.

Shaping the Future Force

Along with promoting institutional change and supporting current operations, the Department continued to incorporate operational energy into the development of future

capabilities. Innovation in science and technology, alternative fuels testing and certification, and adaptations to the requirements and acquisition processes each contribute to the long-term energy performance of the force.

Operational Energy Capability Improvement Fund (OECIF)

Through the OECIF, OE supports long-term improvements in operational energy performance. The OECIF funds multi-year science and technology programs, managed by the Services, focusing on under-addressed operational energy needs. The fund also aims to create institutional momentum to continue those innovations.

Since FY 2012, OECIF has funded an evolving series of programs, as shown in Table 1. By the end of FY 2015, significant progress has been shown in the programs started in FY 2012. A program for contingency base technologies in tropical regions combined improved shelters, environmental control units (ECUs), and lighting with advanced temperature controls to achieve savings of 79 percent. Programs led by the Army and the Navy (in cooperation with the Advanced Research Projects Agency-Energy (ARPA-E)) are improving the energy efficiency of ECUs by as much as 56 percent, with additional savings of 12 percent achievable through improvements in ducting.

Start Year	Focus
FY 2012	Reducing energy load at <u>expeditionary outposts</u> , with an emphasis on energy efficient shelters and cooling
FY 2013	Using <u>consortia</u> to involve a wide variety of organizations to persistently attack key operational energy problems
FY 2014	Analytical <u>methods and tools</u> for considering operational energy in DoD planning and decision processes
FY 2015	Improving fuel economy for the <u>current ground tactical fleet</u> through automation/ smart cruise control, auxiliary electrification, thermally efficient cylinders, and modeling and simulation for lightweighting

In FY 2013, the Department proposed the use of consortia as venues for organizations in and outside of Government to cooperate on specific operational energy challenges. The consortia programs established in FY 2013 focused on 1) soldier and small unit power; 2) expeditionary outpost energy modeling, planning, and control; 3) reducing aircraft aerodynamic drag; and 4) developing open standards for tactical microgrids. The Soldier and Small Unit Power Consortium is taking a comprehensive systems engineering approach to reduce the weight, type, and number of batteries carried by dismounted troops and small units. One initiative is focused on the power demand of radios, and interim results indicate up to a 50 percent average power savings per radio through changes in software and transmission waveform. The Tactical Microgrids Standards Consortium is developing, testing, publishing, and maintaining military specifications for deployable tactical microgrids. The consortium has made significant progress toward establishing a tactical microgrid standard that will allow plug and play operation for any load device to any power device; as a result, the weight of required fuel and equipment may decrease by over 40 percent.

The six programs started in FY 2014 focused on analytical methods and tools addressing operational energy issues throughout DoD's planning, requirements, and management processes. For instance, the Marine Corps is leading a multiservice team developing an expeditionary energy module for the Synthetic Theater Operations Research Model campaign analysis tool. In another program, the U.S. Pacific Command (USPACOM) is leading an effort to insert operational energy factors into the Joint Operational Planning Process, dramatically improving mission planning. Another program is developing energy-related cost/benefit and analytical tools for the airlift and aerial refueling fleets to allow evaluation of fuel logistics effectiveness and resiliency. The Naval Surface Warfare Centers Carderock and Dahlgren are also coordinating on the development of a computer model that examines operational energy requirements in maritime combat scenarios. Lastly, the Army analytical community, through the Operational Energy Analysis Task Force, is developing models and methodologies to examine the effect of operational energy on mission effectiveness.

For FY 2015, the Army Tank Automotive Research, Development and Engineering Center (TARDEC) expanded their work with the DOE Vehicles Technology Office through the Advanced Vehicle Power Technology Alliance (AVPTA) by working together on the *Improving Fuel Economy for the Current Ground Tactical Fleet Program*. This program aims to reduce the fuel consumption of the current tactical ground vehicles fleet, increase the range of vehicles and time on station, and decrease the number of fuel convoys at risk. The four focus areas of the program include automation/smart cruise control, auxiliary electrification, thermally efficient cylinders, and modeling and simulation for reduced vehicle weight. Overall, the four focus areas may collectively achieve a 30-50 percent improvement in current performance, dependent upon platform and operations parameters. Kickoff meetings for this program took place in July and August 2015.

Another new FY 2015 program, the Joint Infantry Company Prototype (JIC-P), is a two-year Marine and Army program combining kinetic energy harvesting technology development efforts with operational testing at the company level to decrease battery weight carried by Warfighters and extend operational reach. In FY 2015, this program obtained energy harvesting equipment and conducted initial performance and safety tests. OECIF is also supporting the USPACOM Joint Deployable Waste to Energy Community of Interest by providing funding for concept of operations and requirements development, development of testing protocols, and testing.

Using the additional FY 2015 funding provided by Congress, OECIF started several shorter-term projects to complement existing OECIF programs or explore new directions. These include the following efforts: develop new Soldier power distribution equipment and a light ultra-capacitor substitute for radio batteries; quantify the cybersecurity threat to energy industrial control systems and how DoD might protect itself; reduce ground-based fuel consumption in

austere environments by leveraging modern behavioral modification techniques; develop and test a membrane-based dehumidification system to reduce the air conditioning energy consumption of ground forces and ships in dock; explore design and analysis tools for new heat exchangers for waste heat recovery and develop a novel heat exchanger for turbine waste heat; demonstrate energy harvesting small, unmanned aerial vehicles; establish an instrumented maritime testbed program to demonstrate and speed adoption of emerging, maritime energy-saving technologies in a shipboard environment; and comparatively assess alternative federation methods (manual versus automated) for modules, simulations, and tools used by DoD when conducting operational energy related analyses.

Alternative Fuel Initiatives

DoD alternative fuel activities are guided by DoD Directive 4180.01, “DoD Energy Policy,” which states that DoD will “[d]iversify and expand energy supplies and sources, including renewable energy sources and alternative fuels,” as well as DoD Instruction 4140.25, “DoD Management Policy for Energy Commodities and Related Services,” which formalized the requirement that alternative fuels procured for operational purposes be “drop-in” and cost competitive with conventional fuels.¹³ Consistent with these policies, in FY 2015, the Department supported alternative fuel initiatives associated with testing and evaluation, bulk procurement, and fuel production support.

- **Testing and Evaluation.** In FY 2015, the Services focused the majority of their alternative fuels efforts on testing and evaluating the use of drop-in alternative fuels in aircraft, ships, tactical vehicles, and support equipment. These efforts aim to enable the Services to use a range of fuels produced from widely available non-petroleum feedstocks. As new alternative fuels enter global commercial energy supply chains and become cost-competitive with conventional fuels, testing and evaluation ensures that the Department’s use of alternative fuels will not adversely affect the mission. In August 2015, the Deputy Assistant Secretaries for Energy of the Military Departments signed a memorandum stating that JP-8, Jet A, and Jet A-1 containing up to 50 percent drop-in alternative fuels produced through two pathways are, or will be, qualified for use in tactical platforms by the end of calendar year 2015, and requested that DLA-E specify these blends are eligible to compete in future bulk fuel solicitations.
- **Bulk Procurement.** Reflecting progress in qualifying alternative fuels, DLA-E’s bulk fuel solicitations now accept blends that contain drop-in alternative fuels. In the 2015 Rocky Mountain/West Coast/Offshore Bulk Fuels annual purchase program, DLA-E solicited

¹³ DoDD 4180.01 is available at: http://www.dtic.mil/whs/directives/corres/pdf/418001_2014.pdf. DoDI 4140.25 is available at www.dtic.mil/whs/directives/corres/pdf/414025p.pdf

F-76 and JP-5 blends containing qualifying drop-in alternative fuels within the total volume of approximately 142 and 139.8 million gallons, respectively, for deliveries starting in October 2015. As part of the “Farm-to-Fleet” partnership between the Navy and the Department of Agriculture (USDA), the USDA offered a per-gallon incentive of up to \$0.25 per gallon for fuels containing qualifying 10-50 percent biofuel blends.¹⁴ In September 2015, DLA-E announced that, for the first time ever, a biofuel supplier will be providing the Navy with approximately 78 million gallons of F-76 containing 10 percent biofuel.

- **Production Support.** DoD also is participating in an interagency initiative to support the construction of three facilities to produce cost-competitive drop-in alternative fuels for military and commercial use. Led by the Office of the Deputy Assistant Secretary of the Defense for Manufacturing and Industrial Base Policy, the Defense Production Act Title III Advanced Drop-in Biofuels Production Project is a partnership with the private sector and the Departments of Energy and Agriculture. Construction of the first facility located in McCarran, Nevada, began in June 2015. The second and third facilities, to be located in Oregon and the Texas Gulf Coast region, are anticipated to commence construction in the first and second quarters of 2016.

Cooperation with the Department of Energy

In FY 2010, DOE signed a Memorandum of Understanding (MOU) to “strengthen and broaden” collaboration with DoD in energy technology.¹⁵ In FY 2015, the MOU initiatives included:

- **Hybrid Energy Storage Module (HESM).** For this program, each Service is developing modular hybrid energy storage modules with high power and energy densities that address long endurance and rapid charge/discharge needs for forward operating bases, aircraft power management, and future shipboard weapons systems. HESM is closely coordinated with ARPA-Es Advanced Management and Protection of Energy-storage Devices program, which will be used to potentially extend the operational performance benefits and safety of the HESMs. The forward operating track demonstrated a unit in November 2014, and two of the shipboard systems had demonstrations in May and July 2015.
- **AVPTA.** In addition to the efforts described above under OECIF FY 2015 funding,

¹⁴ A similar solicitation closed in February 2015 for the Inland East/ Gulf Coast region, but no awards were made for the supply of biofuel-blended fuels, as none of the bidders demonstrated the capability to produce drop-in renewable F-76 or JP-5 within military fuel specifications at sufficient scale.

¹⁵ This document is available at <http://energy.gov/sites/prod/files/edg/news/documents/Enhance-Energy-Security-MOU.pdf>

Army's TARDEC and DOE's Vehicle Technologies Office continue a very successful partnership in place since July 2011. Collaborative research and development (R&D) efforts for vehicle technology include advanced combustion, engines and transmissions, lightweight structures and materials, energy recovery and thermal management, alternative fuels and lubricants, electrified propulsion systems, and energy storage and batteries.

- DOE Big Ideas Summit. In April 2015, DOE held its annual Big Ideas Summit which included three topics for collaboration with DoD: 1) energy harvesting for the Warfighter, squad, and forward operating base; 2) thermal energy management; and 3) microgrids. Teams of subject matter experts from DOE and DoD prepared five proposals in the three areas. As of the end of FY 2015, DOE leadership was considering which of the proposals to move forward.
- DOE Advisors at Combatant Commands. DOE Energy Advisors assigned to USPACOM, USCENTCOM, and USAFRICOM help integrate energy into planning, exercises, programs, and engagements.

Operational Energy in Force Development

Building on success in FY 2014 associated with wargames and Energy Supportability Analyses (ESAs), the Department consolidated and deepened the role of operational energy in requirements and acquisition decision-making.

Wargames are being used to identify and assess future operational energy constraints and opportunities. The Air Force's Title X war games, Unified Engagement 2014 and Futures Game 2015, each identified energy as a significant constraint when conducting major combat operations in an anti-access/area denial environment. These games identified issues that need to be addressed related to repositioning or war reserve stock and forward precision positioning of fuel. The Marine Corps conducted an excursion to their Title X wargame, Expeditionary Warrior 2015, called Operational Reach 2015, to assess the energy supportability requirements of a heavy Marine Expeditionary Brigade during an amphibious assault. These results will now support a range of ESAs for new programs. In addition, DLA-E conducted a wargame on the challenges associated with bulk fuel movement in the current day Pacific theater under wartime conditions. This strategic view of energy identified shortfalls that the Department is currently addressing with a variety of improved commercial supply chain and partner-nation capacity building initiatives. Similar initiatives are also being applied in U.S. Northern Command and U.S. European Command to address fuel shortfalls in those combatant commands.

The Joint Staff J-4 and the OASD(EI&E) assessed Service use of the eKPP in new and

updated systems and collaborated with Service energy and requirements offices to improve the development of eKPPs and the role of ESAs. The Services are developing analytical tools, techniques, and products to better inform requirements development and force structure decisions. In some cases, due to the status of the program, the Service conducted an ESA after the approval of the requirements document (e.g., Amphibious Assault Ship LHA-R, cargo helicopter CH-53K, and Joint Light Tactical Vehicle) with the understanding that the analysis will be presented later to the Joint Requirements Oversight Council.

Each of these efforts translates directly to reduced risk or improved operational capabilities through increased range, payload, endurance, and/or time on station.

As programs move from requirements to acquisition, ASD(EI&E) continued to act as an advisor to the Defense Acquisition Board (DAB), chaired by the Department's Acquisition Executive. In FY 2015, there were approximately 10 DAB acquisition program reviews with an equal number of preparatory meetings for programs that consumed significant quantities of operational energy. In that capacity, OASD(EI&E) ensured that operational energy issues were addressed as part of Overarching Integrated Product Team (OIPT) deliberations in advance of DAB decisions, and resolved questions raised during program reviews.

Finally, there are several specific science and technology programs with the potential to dramatically increase the energy performance and capability of several major systems, including:

- The Air Force is developing an adaptive, three-stream engine transition program (Adaptive Engine Transition Program (AETP)) for combat aircraft that produces greater thrust while being 25 percent more fuel efficient.
- The Army expects the Improved Turbine Engine Program to improve the range, endurance, and payload capacity of the Blackhawk and Apache helicopters, and increase their operational availability in difficult terrain while reducing maintenance costs by 35 percent and reducing fuel consumption by 12 to 25 percent.
- The Marine Corps is developing a fuel efficient Medium Tactical Vehicle Replacement with 15 percent greater fuel efficiency compared to the current medium tactical vehicle.
- The Navy is pursuing hybrid electric drives on their Arleigh Burke-class destroyers that will allow ships to remain on station for longer periods of time.

Conclusion

Even as the Department sustained operations against irregular adversaries in the Middle East, the 2014 *Quadrennial Defense Review's* emphasis on the Asia-Pacific region will further increase the demand for fuel as operations must be conducted across vast distances. Next-generation weapons platforms and concepts of operation—while much more capable—

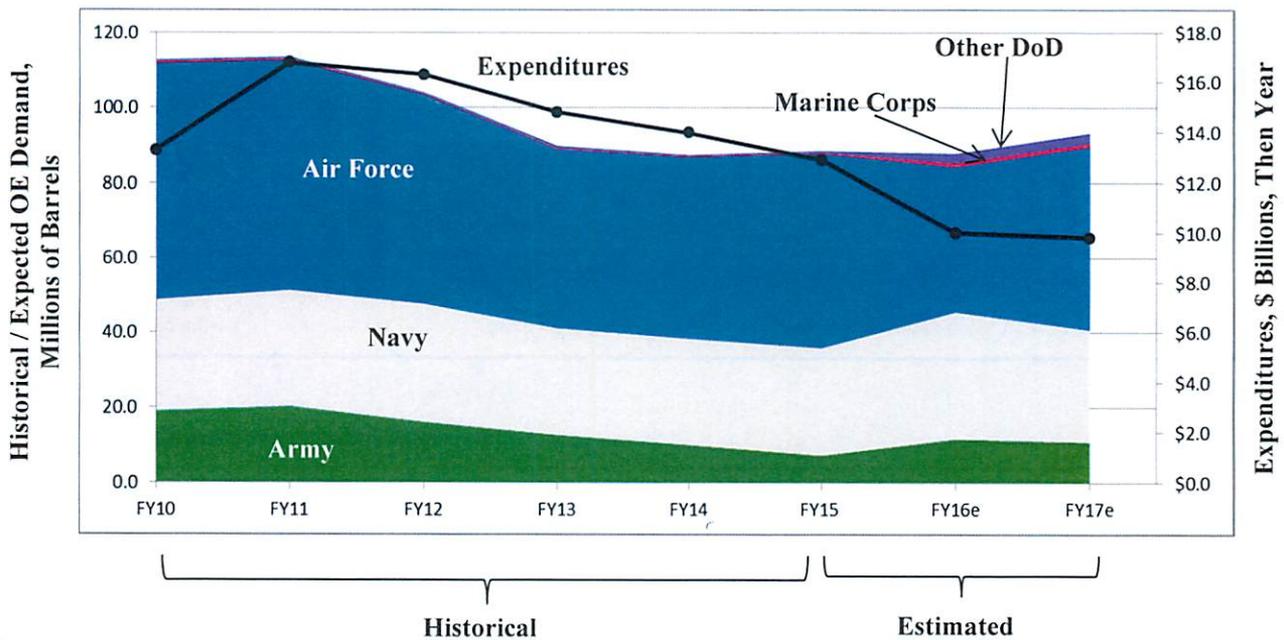
increasingly use more energy than their predecessors and face much more lethal adversaries. In short, risks to the underpinnings of U.S. power projection, particularly the availability of operational energy, are an enduring challenge. Staying ahead of this challenge will require a concerted effort across the Department.

This challenge shaped the Department's activities in 2015. Training and education, wargames, current operations, and adaptations in force development each illustrate the progress being made in how the Department generates, uses, and plans to use energy. The Department continues to appreciate the support of Congress helping achieve the operational energy mission in support of the Warfighter.

Appendix A: Historical and Estimated Demand for Operational Energy

The figure and table below describe the historical demand for operational energy in FY 2010–2015, estimated demand for operational energy in FY 2016–2017, and total expenditures to purchase that fuel. Historical operational energy demand is based on net sales of selected liquid fuels by DLA-E to the Services, while future operational energy demand estimates are based on the FY 2017 President’s Budget. Expenditures for operational energy are estimated using the average fuel sales price for the specific fuel provided to the customer at the point of sale and include procurement and overhead costs. This price does not reflect additional costs imposed on the Department for force protection, storage, and transportation beyond the point of sale. As a purchaser of fuel on the open market, the Department is subject to the same price volatility experienced by commercial customers.

Figure 1: DoD Operational Energy Demand, FY 2010 – FY 2017¹⁶



¹⁶ Updated analysis of expenditures may lead to different results from previous Operational Energy Annual Reports. Expenditures are not adjusted for inflation; data on historical demand may not capture final end use nor account for fuel transfers between the Services; Historical and Estimated Demand include Base and Overseas Contingency Operations (OCO) funding and purchases using Transportation Working Capital Fund (TWCF).

Table 2: DoD Operational Energy Demand by Service

		FY10	FY11	FY12	FY13	FY14	FY15	FY16e	FY17e
Operational Energy Demand, Million Barrels	Army	19.0	20.2	16.1	12.7	10.1	7.3	11.7	10.9
	Navy	29.7	31.1	31.5	28.4	28.2	28.5	33.8	29.8
	Air Force	63.0	61.3	55.7	47.8	48.6	52.0	38.8	48.9
	Marine Corps	0.4	0.3	0.2	0.2	0.2	0.2	0.8	0.8
	Other DoD	0.5	0.5	0.4	0.7	0.3	0.5	2.7	2.8
	Total Demand	112.6	113.5	103.9	89.8	87.4	88.6	87.9	93.3
	Expenditures, \$ Billions	\$13.3	\$16.8	\$16.3	\$14.8	\$14.0	\$12.9	\$10.0	\$9.8

**Appendix B: Assessment of Fiscal Year 2015 President’s Budget
Operational Energy Initiatives**

In 2014, the Department assessed the FY 2015 President’s Budget against the three goals of the 2011 *Operational Energy Strategy*:

- Reduce Demand
- Diversify Supply
- Adapt the Future Force

In addition, the operational energy initiatives were placed in three broad investment categories that reflect the underlying intent of the investment: Research, direct/indirect. Research investments are intended to advance our future technological edge. Direct investments specifically target operational energy improvements while indirect investments are made for other than operational energy purposes but have the effect or outcome of improving energy performance or diversifying energy sources.

The method used to assess initiative investments included joining with the Director, Cost Assessment and Program Evaluation (D,CAPE), to evaluate operational energy investments within the Program Budget Review cycle. Next, the ASD(EI&E) formed a Certification Advisory Working Group with representatives from the Office of the Deputy Assistant Secretary of Defense for Operational Energy, the Office of Under Secretary of Defense (Comptroller), CAPE, the Joint Staff, and the Services to validate operational energy initiatives and provide recommendations on the adequacy of resourcing the goals of the 2011 *Operational Energy Strategy*.

Table 3 shows the DoD operational energy initiative funding by Service throughout the Future Years Defense Program (FYDP) of FY 2015 to FY 2019.

**Table 3. DoD Operational Energy Initiatives by Service
(Dollars in Thousands, FY2015 PB)**

	FY 2015	Percent	FYDP	Percent
Air Force	668,928	38.7%	3,055,335	29.0%
Army	651,843	37.7%	5,382,662	51.2%
Marines	37,964	2.2%	261,901	2.5%
Navy	328,919	19.0%	1,575,858	15.0%
Defense -Wide	41,114	2.4%	237,288	2.3%
Total	1,728,768	100%	10,513,044	100%

Table 4 summarizes DoD’s operational energy investments by the goals found in the

2011 *Operational Energy Strategy*. As in previous years, investments that improve the future force investments appear to be disproportionately lower, as they represent improvements in modeling, simulation, analysis, and the broader requirements process. That does not mean they have less effect, and indeed, these investments ultimately drive investments across major accounts, such as research, development, test, and evaluation (RDT&E) and procurement.

**Table 4. DoD Operational Energy Initiatives by Goal
(Dollars in Thousands, FY2015 PB)**

	FY 2015	Percent	FYDP	Percent
Reduce Demand	1,576,294	91.2%	9,825,779	93.5%
Diversify Supply	135,745	7.8%	612,746	5.8%
Adapt the Future Force	16,729	1.0%	74,519	0.7%
Total	1,728,768	100.0%	10,513,044	100.0%

The Assistant Secretary of Defense for Operational Energy Plans and Programs determined the FY 2015 President’s Budget was adequate to implement the objectives of the 2011 *Operational Energy Strategy*. Table 5 depicts the assessment of Service initiatives against the goals of the 2011 *Operational Energy Strategy*.

Table 5. Assessment

Operational Energy Objectives	Air Force	Army	Marines	Navy
Reduce Demand				
Diversify Supply				
Adapt the Future Force	Y/G			

While the Components generally reduced funding for operational energy initiatives in amounts proportional to their reduced fiscal guidance, the Army increased funding in the FY 2015-2019 FYDP as compared to the FY 2014-2018 FYDP, and the Department restored funding during the Program Budget Review to the Air Force’s Adaptive Engine Technology Development (AETD) program. However, the Department remains concerned with future budget sequestration potential effects on readiness and future force development.

Specific concerns include:

- The two-year schedule delay for the Army’s Improved Engine Program (ITEP) due to a lack of developmental funding will slow procurement of rotary wing engines that provide increased maximum operating range and temperature while reducing fuel consumption by 25 percent. Further advances in the ITEP have the potential to deliver significant capability to other Services UH-60 fleets such as Combat Search and Rescue helicopters.

In addition, sustainment funding for the Inland Petroleum Distribution system is minimal which may impact the Army's tactical distribution of bulk fuel.

- The Navy's Hybrid Electric Drive (HED) improves fuel economy and has the potential to increase a ship's time on station by as much as 2.5 days between refuelings when used 50 percent of the time. While funding was reduced in FY 2015 by congressional marks due to programmatic changes to the schedule for testing, evaluation, and implementation, the Navy remains committed to the DDG-51 Class HED program and will also continue to pursue auxiliary propulsion in L-class amphibious ships as programmed.
- While the Marine Corps made considerable progress in the pursuit of modeling tools, the Department would like to see the Services build on this progress and develop additional simulation tools to incorporate operational energy into force structure and force allocation decisions throughout DoD.
- The Operational Energy Capability Improvement Fund (OECIF) funds DoD research programs intended to improve the operational energy performance of the Department and build institutional momentum for further research and improvements in the areas it supports. However, one concern is the Military Departments have not always budgeted and planned adequately in order to capitalize on the progress these programs have made and sustain their momentum. For four years starting in in FY 2012, OECIF funded a joint Army/Air Force program, titled *Advanced Energy Efficient Shelter Systems* (AEESS), for more energy efficient shelters, and an Army program, titled *Innovative Cooling Equipment* (ICE), for more energy efficient ECUs. While the Army has a transition plan for AEESS, it has not set aside any funding for transition. Similarly, the Air Force has not planned funding for following up on AEESS. With ICE, while the Army has some ideas on how to transition the results, the Army's budget does not contain funding to either transition the results or continue any research in ECUs.
- The Air Force has made investments to improve the quality and availability of energy-informed models and simulations and included these tools into the requirements and acquisition process (e.g., the ESA for the KC-46A). In addition, the Air Force Secretariat has provided staff to specifically support the execution of the eKPP and ESA tasks identified in the JCIDS Manual. Looking forward, the Department encourages the Air Force to institutionalize this analytical and staff capacity with long-term, dedicated funding.

Tables 6-10 identify the specific operational energy initiatives funded in the FY 2015 President's Budget.

**Table 6. Air Force FY 2015 Operational Energy Initiatives
(Dollars in Thousands)**

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Air Force	Aerospace Propulsion	Develop an integrated suite of efficient, mission adaptive, robust electrical and thermal management systems to reduce aircraft energy demand	Reduce Demand	Research	3600	02	0602203F	4,500	0	0
Air Force	Aerospace Propulsion	INVENT. Develop an integrated suite of efficient, mission adaptive, robust electrical and thermal management systems to reduce aircraft energy demand	Reduce Demand	Research	3600	02	0602203F	4,000	0	0
Air Force	Aerospace Propulsion	Development of concepts, subsystems, and components for controlling power and actuation.	Reduce Demand	Research	3600	02	0602203F	0	6,323	31,654
Air Force	Aerospace Propulsion	Efficient power distribution on aircraft	Reduce Demand	Research	3600	02	0602203F	0	3,937	21,084
Air Force	Aerospace Propulsion and Power Technology	AETD. Mature ADVENT Technologies and accelerate EMD with preliminary design and risk reduction	Reduce Demand	Research	3600	03	0603216F	59,200	45,984	90,796
Air Force	Aerospace Propulsion and Power Technology	ESSP. Develop 10X propulsion capability for small engines that increase thrust to weight and decrease specific fuel consumption	Reduce Demand	Research	3600	03	0603216F	6,000	0	15,420
Air Force	Aerospace Propulsion and Power Technology	Demonstrate fuels for performance, environmental impact and system operations	Diversify Supply	Research	3600	03	0603216F	2,500	2,300	11,600
Air Force	Aerospace Propulsion and Power Technology	HEETE. Demonstrate fuel efficient large fan/jet propulsion technologies supporting extreme endurance and range	Reduce Demand	Research	3600	03	0603216F	0	9,710	103,802
Air Force	Aerospace Propulsion and Power Technology	INVENT. Demonstrate advanced aircraft subsystem components for on-demand subsystems	Reduce Demand	Research	3600	03	0603216F	7,500	0	0
Air Force	Aerospace Technology Development/ Demonstration	AETD. Demonstrate design technologies for risk reduction of ADVENT technologies that accelerate EMD preliminary design and risk reduction	Reduce Demand	Research	3600	03	0603211F	20,000	0	0
Air Force	Aerospace Technology Development/ Demonstration	Demonstrate technologies to integrate very high bypass ratio engines and open rotor engine designs into advance aircraft configurations	Reduce Demand	Research	3600	03	0603211F	2,500	0	0
Air Force	Aerospace Technology Development/ Demonstration	Demonstrate light weight composite structures to reduce weight, manufacturing cost and are air worthiness certifiable	Reduce Demand	Research	3600	03	0603211F	2,700	1,500	3,700

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Air Force	Aerospace Technology Development/ Demonstration	Modeling and sim and aero components to support advanced configurations	Reduce Demand	Research	3600	03	0603211F	0	0	18,147
Air Force	Aerospace Technology Development/ Demonstration	Integrated advanced propulsion concepts to improve fuel efficiency	Reduce Demand	Research	3600	03	0603211F	0	289	18,122
Air Force	Aerospace Technology Development/ Demonstration	Demonstrate Technologies to reduce aircraft drag and improve fuel burn	Reduce Demand	Research	3600	03	0603211F	12,900	1,000	25,500
Air Force	Aerospace Technology Development/ Demonstration	\$AVE. Drag reduction through formation flying.	Reduce Demand	Research	3600	03	0603211F	0	1,930	4,258
Air Force	Aerospace Vehicle Technologies	Certification of non-metallic materials	Reduce Demand	Research	3600	02	0602201F	0	5,344	49,441
Air Force	Aerospace Vehicle Technologies	Develop technologies to integrate very high bypass ratio engines and open rotor engine designs into advance aircraft configurations	Reduce Demand	Research	3600	02	0602201F	4,000	0	0
Air Force	Aerospace Vehicle Technologies	Develop formation flight strategies to minimize mission fuel burn	Reduce Demand	Research	3600	02	0602201F	2,200	0	0
Air Force	Aerospace Vehicle Technologies	Enhancements to current platforms to reduce drag and improve efficiency	Reduce Demand	Research	3600	02	0602201F	0	366	5,925
Air Force	Aerospace Vehicle Technologies	Enhancements to current platforms to reduce drag and improve efficiency	Reduce Demand	Research	3600	02	0602201F	0	2,655	11,532
Air Force	Aerospace Vehicle Technologies	Develop light weight composite structures to reduce weight, manufacturing cost and are air worthiness certifiable	Reduce Demand	Research	3600	02	0602201F	5,200	0	0
Air Force	Aerospace Vehicle Technologies	Advanced aerodynamic configurations for low drag and high volume	Reduce Demand	Research	3600	02	0602201F	0	877	7,275
Air Force	Aerospace Vehicle Technologies	Advanced aerodynamic configurations for low drag and high volume	Reduce Demand	Research	3600	02	0602201F	0	2,214	8,660
Air Force	Aerospace Vehicle Technologies	Advanced aerodynamic configurations for high strength to weight	Reduce Demand	Research	3600	02	0602201F	0	403	10,965
Air Force	Aerospace Vehicle Technologies	Modeling and sim and aero components to support advanced configurations	Reduce Demand	Research	3600	02	0602201F	0	4,823	26,788

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Air Force	Aerospace Vehicle Technologies	Integrated advanced propulsion concepts to improve fuel efficiency	Reduce Demand	Research	3600	02	0602201F	0	100	648
Air Force	Aerospace Vehicle Technologies	Integrated advanced propulsion concepts to improve fuel efficiency	Reduce Demand	Research	3600	02	0602201F	0	4,343	23,122
Air Force	Aerospace Vehicle Technologies	Develop fuel burn reduction technologies for the legacy and future fleets	Reduce Demand	Research	3600	02	0602201F	12,900	0	0
Air Force	Aerospace Vehicle Technologies	RCEE. Enhance system capability and reduce fuel burn with advanced air vehicle designs	Reduce Demand	Research	3600	02	0602201F	9,800	0	0
Air Force	Aerospace Vehicle Technologies	\$SAVE. Drag reduction through formation flying.	Reduce Demand	Research	3600	02	0602201F	0	250	1,250
Air Force	Aerospace Vehicle Technologies	\$SAVE. Drag reduction through formation flying.	Reduce Demand	Research	3600	02	0602201F	0	450	1,200
Air Force	Aircraft Sustainment	Certification of non-metallic materials	Reduce Demand	Research	3600	03	0603199F	0	2,354	29,737
Air Force	AMC Command & Control	The Advanced Computer Flight Plan Overlay is a command and control system that provides an optimized solution to navigational and fuel computations. Flight plans are route, altitude, and fuel optimized based on forecasted winds, temperatures and planned payload weight which allows a reduction in fuel use by an aircraft. The reduction in fuel use allows greater load capacity in the aircraft reducing total number of flights and saving costs.	Reduce Demand	Indirect	3400	02	0401840F	37	0	0
Air Force	AMC Command & Control	Procured COTS Mission Indexed Flying (MIF) software for KC-10, & KC-135 fleets to use inflight to reduce fuel consumption by flying optimum altitudes and speeds; also procured for C-17 and C-5 fleets using TWCF funds	Reduce Demand	Indirect	3400	02	0401840F	37	37	187
Air Force	C17	This is a fuel efficiency initiative for updating the C-17 ACARS standard message set for fuel analysis. The modification is ongoing. Once completed the AMC Fuel Efficiency Office will track and analyze fuel usage.	Reduce Demand	Indirect	3010	07	0401130F	1,500	0	0
Air Force	C-5 Airlift Squadrons	Fuel efficiency was not the primary driver for the RERP modification and with only 9 aircraft modified at this point there is not enough data to predict savings in the out years	Reduce Demand	Indirect	3010	05	0401119F	1,153,900	334,749	334,749
Air Force	Defense Research Sciences	To develop new methods to slit and store hydrogen, turn CO2 into fuels using solar energy and to produce hydrogen with photosynthetic molecules	Diversify Supply	Research	3600	01	0601102F	2,000	800	4,400
Air Force	Defense Research Sciences	Optimizing efficiency through computational data decisions with regard to which data to absorb, when it should be absorbed, and how it should be absorbed.	Reduce Demand	Research	3600	01	0601102F	1,000	800	4,400
Air Force	Defense Research Sciences	Develop "self-powered" load-bearing structures with integrated energy harvest/storage capabilities, and to establish new multi-functional design rules	Diversify Supply	Research	3600	01	0601102F	6,000	5,000	25,900

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Air Force	Defense Research Sciences	To develop detailed and reduced mechanisms for the combustion of surrogates of petroleum fuels	Diversify Supply	Research	3600	01	0601102F	500	500	2,500
Air Force	Defense Research Sciences	Determine if carbon nanostructures may lead to the discovery of highly efficient photovoltaics, thermoelectrics, and new super conductors	Reduce Demand	Research	3600	01	0601102F	6,000	5,000	25,900
Air Force	Defense Research Sciences	Develop highly efficient >40% solar cells	Diversify Supply	Research	3600	01	0601102F	4,700	4,100	23,200
Air Force	Dominant Info Sciences and Methods	Demonstrate significant , information processing size, weight, and power performance gains using 3D chip stacking with logic-on-logic integration	Reduce Demand	Research	3600	02	0602788F	300	0	0
Air Force	Dominant Info Sciences and Methods	Energy efficient, multifunction processing	Reduce Demand	Research	3600	02	0602788F	0	0	16,998
Air Force	Dominant Info Sciences and Methods	Energy efficient, multifunction processing	Reduce Demand	Research	3600	03	0603788F	0	0	1,622
Air Force	Dominant Info Sciences and Methods	Develop CMOS compatible methods to fabricate energy efficient hybrid circuits and systems	Reduce Demand	Research	3600	02	0602788F	200	0	0
Air Force	Dominant Info Sciences and Methods	Develop Memristor and CMOS technologies to improve energy efficient computing	Reduce Demand	Research	3600	02	0602788F	1,250	0	0
Air Force	Dominant Info Sciences and Methods	Develop next generation energy efficient processing capabilities	Reduce Demand	Research	3600	02	0602788F	0	2,268	4,068
Air Force	Dominant Info Sciences and Methods	Develop revolutionary quantum computing processors	Reduce Demand	Research	3600	02	0602788F	520	0	0
Air Force	Dominant Info Sciences and Methods	Attack resistant and energy efficient processor	Reduce Demand	Research	3600	02	0602788F	0	3,783	28,543
Air Force	Dominant Info Sciences and Methods	Develop an attack resilient energy efficient processor	Reduce Demand	Research	3600	02	0602788F	1,100	0	0
Air Force	Expeditionary Energy Technology	BEAR. RDT&E effort to develop deployable phase-change material (PCM)-equipped systems designed to pre-cool or pre-heat incoming air to environmental control units.	Reduce Demand	Indirect	3600	05	0604617F	800	0	0
Air Force	Dominant Info Sciences and Methods	Develop an attack resilient energy efficient processor	Reduce Demand	Research	3600	02	0602788F	1,100	0	0
Air Force	Expeditionary Energy Technology	BEAR. RDT&E effort to develop deployable phase-change material (PCM)-equipped systems designed to pre-cool or pre-heat incoming air to environmental control units.	Reduce Demand	Indirect	3600	05	0604617F	800	0	0

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Air Force	Expeditionary Energy Technology	RDT&E effort to develop the BEAR System for Load & Installation Management (BSLIM), a centralized load management of the BEAR power grid, power critical loads during power outage, and integration of RE	Reduce Demand	Indirect	3600	05	0604617F	1,700	0	0
Air Force	Expeditionary Energy Technology	RDT&E effort to develop deployable phase-change material (PCM)-equipped systems designed to pre-cool or pre-heat incoming air to environmental control units.	Reduce Demand	Direct	3600	05	0604617F	800	0	0
Air Force	Expeditionary Energy Technology	RDT&E effort to develop autonomous, in-shelter smart control systems for expeditionary structures.	Reduce Demand	Direct	3600	05	0604617F	1,200	0	0
Air Force	Human Effectiveness Applied Research	Develop and demonstrate interactive toolset for live virtual training	Reduce Demand	Research	3600	03	0603456F	2,300	2,900	20,100
Air Force	KC135	This is a fuel efficiency initiative for updating the KC 135 ACARS standard message set for fuel analysis. The modification is ongoing. Once completed the AMC Fuel Efficiency Office will track and analyze fuel usage.	Reduce Demand	Indirect	3400	02	0401218F	1,955	500	500
Air Force	KC-135s	KC-135. CFM Propulsion Upgrade Program (C-PUP) inserts modern technology into F-108 engine. Initiative will change/upgrade the high pressure (HP) turbine nozzle, turbine shroud assembly, turbine blades and compressor blades/vanes.	Reduce Demand	Indirect	3400	02	0401218F	23,300	24,000	74,400
Air Force	ManTech	Accelerate manufacturing producibility of >33% efficient solar cells	Diversify Supply	Research	3600	03	0603680F	4,100	4,016	8,585
Air Force	Materials	2700 DEG. Develop and predict behavior and life of SiC/SiC ceramic disk composites for ADVENT and HEETE engine demonstrators	Reduce Demand	Research	3600	02	0602102F	8,200	8,793	22,784
Air Force	Materials	Mature materials & processes technology enabling demo of VAATE Goals	Reduce Demand	Research	3600	02	0602102F	0	0	14,406
Air Force	Materials	Develop new materials and architectures for advanced energy and power devices	Reduce Demand	Research	3600	02	0602102F	2,800	2,565	9,655
Air Force	Materials	Accelerate materials design/development/test cycle for energy efficient aircraft design	Diversify Supply	Research	3600	02	0602102F	8,100	6,752	14,662
Air Force	Materials	Develop high energy density capacitor materials	Diversify Supply	Research	3600	02	0602102F	1,300	0	0
Air Force	Materials	Mature hybrid disk technology and new high temperature alloys	Reduce Demand	Research	3600	02	0602102F	0	985	17,768
Air Force	SAF/IEN Funding	Develop policy and framework to support OE	Future Force	Direct	3400	04	0905015F	2,142	2,142	9,102
Air Force	Space Technology	Develop solar cells for space power generation that are 33% - 37% efficient	Diversify Supply	Research	3600	02	0602601F	4,200	4,200	22,400
Air Force	Space Technology	Develop solar cells for space power generation that are 33% - 37% efficient	Diversify Supply	Research	3600	03	0603401F	1,400	1,200	7,000
Air Force	University Research Initiative	Develop carbon nanostructures for new logic gates, highly efficient photovoltaics, thermoelectrics, and fuel cells	Diversify Supply	Research	3600	01	0601103F	3,000	4,500	16,500

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Air Force	Advanced Materials for Weapon Systems	2700 DEG. Demonstrate SiC/SiC ceramic disk composites for ADVENT and HEETE engine demonstrators	Reduce Demand	Research	3600	03	0603112F	0	388	26,220
Air Force	Advanced Materials for Weapon Systems	AETD. Demonstrate advanced high temperature materials for risk reduction of ADVENT technologies that accelerate EMD preliminary design and risk reduction	Reduce Demand	Research	3600	03	0603112F	2,000	0	0
Air Force	Aerospace Propulsion	AETD. Mature ADVENT technologies and accelerate EMD with preliminary design and risk reduction	Reduce Demand	Research	3600	02	0602203F	27,500	13,337	21,440
Air Force	Aerospace Propulsion	AETD. Mature ADVENT technologies and accelerate EMD with preliminary design and risk reduction	Reduce Demand	Indirect	3600	04	0604858F	13,600	59,741	97,383
Air Force	Aerospace Propulsion	Advanced power storage on aircraft for subsystems	Reduce Demand	Research	3600	02	0602203F	0	2,408	31,307
Air Force	Aerospace Propulsion	Advanced components subsystems and components to manage heat rejection	Reduce Demand	Research	3600	02	0602203F	0	3,444	12,548
Air Force	Aerospace Propulsion	ESSP. Develop 10X propulsion capability for small engines that increase thrust to weight and decrease specific fuel consumption	Reduce Demand	Research	3600	02	0602203F	1,500	2,000	12,388
Air Force	Aerospace Propulsion	Subsystems and components to manage actuation	Reduce Demand	Research	3600	02	0602203F	0	2,704	15,541
Air Force	Aerospace Propulsion	Evaluate advanced fuels for performance, environmental impact and system operations	Diversify Supply	Research	3600	02	0602203F	5,300	5,200	26,700
Air Force	Aerospace Propulsion	HEETE. Develop fuel efficient large fan/jet propulsion technologies supporting extreme endurance and range	Reduce Demand	Research	3600	02	0602203F	11,700	5,110	50,548
Air Force	Aerospace Propulsion	"INPAT" follow on effort to INVENT. New, advanced, aircraft power and thermal management subsystem architecture	Reduce Demand	Research	3600	02	0602203F	0	0	14,558
Air Force	Aerospace Propulsion	AETD/AETP. Mature adaptive turbine engine technologies for next generation propulsion systems	Reduce Demand	Research	3600	04	0604858F	27,500	57,854	1,515,747
							TOTAL AIR FORCE OE	1,491,741	668,928	3,055,335

**Table 7. Army FY 2015 Operational Energy Initiatives
(Dollars in Thousands)**

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Army	Aviation Advanced Technology	Advanced technology demonstration of power system technologies through design, fabrication, and evaluation of advanced engine components in order to improve the performance of turbine engines for rotorcraft.	Diversify Supply	Research	2040	03	0603003A	0	0	17,297
Army	Aviation Advanced Technology	Matures and demonstrates drive system components, subsystems and systems for rotorcraft (both manned and unmanned) that provide, improved aircraft & occupant survivability, reduced maintenance & sustainment costs, and greater performance.	Diversify Supply	Research	2040	03	0603003A	6,200	6,986	6,986
Army	Aviation Advanced Technology	Matures and demonstrates rotorcraft turbine engine technologies through design, fabrication, and evaluation of advanced engine components in order to improve the performance of turbine engines for rotorcraft.	Diversify Supply	Research	2040	03	0603003A	8,272	8,254	16,530
Army	Aviation Advanced Technology	Matures and demonstrates components, subsystems and systems for rotorcraft (both manned and unmanned) that provide, improved aircraft & occupant survivability, reduced maintenance & sustainment costs, and greater performance through improved rotors, and drive systems.	Reduce Demand	Research	2040	03	0603003A	0	0	6,032
Army	Aviation Combined Arms Tactical Trainer	Simulators for aviation asset collective training.	Reduce Demand	Indirect	2035	03	0219900A	34,913	14,440	162,964
Army	Aviation Combined Arms TT	Simulators for aviation asset collective training.	Reduce Demand	Indirect	2040	05	0604780A	3,826	11,671	28,007
Army	Aviation Simulator	Simulator for the Apache Helicopter.	Reduce Demand	Indirect	2031	01	0210100A	14,816	15,098	78,413
Army	Aviation Simulator	Simulator for the Blackhawk Helicopter.	Reduce Demand	Indirect	2031	01	0210101A	10,690	21,760	43,910
Army	Aviation Simulator	Chinook Transportable Flight Proficiency Simulator (TFPS)	Reduce Demand	Indirect	2031	01	0210104A	17,320	17,745	93,126
Army	Aviation Technology	Applied research in high efficiency engine component technology for manned and unmanned rotary wing aircraft.	Diversify Supply	Research	2040	02	0602211A	0	0	10,957
Army	Aviation Technology	This project investigates engine, drive train and airframe enabling technologies such as multifunctional materials and fluid mechanics.	Reduce Demand	Research	2040	02	0602211A	2,885	2,024	12,754
Army	Aviation Technology	This project investigates engine, drive train and airframe enabling technologies such as multifunctional materials and fluid mechanics.	Reduce Demand	Research	2040	02	0602211A	3,095	3,083	3,083
Army	Aviation Technology	Design and evaluate rotary wing technology for manned and unmanned Army/DoD aircraft. Areas of research include enhanced rotor efficiencies, and improved engine performance.	Reduce Demand	Research	2040	02	0602211A	1,930	2,000	15,466

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Army	Ballistics Technology	This project designs, develops, and evaluates a variety of innovative enabling technologies in the areas of energetics and energetics propulsion management, propulsion, mobility, survivability, vehicle diagnostics, fuels, and lubricants.	Reduce Demand	Research	2040	02	0602618A	4,671	8,090	41,343
Army	Combat Vehicle and Automotive Advanced Technology	This project matures and demonstrates advanced mobility and electric technologies for advanced propulsion power, and electrical components and subsystems to enable lightweight, agile, deployable, fuel efficient, and survivable ground vehicles.	Reduce Demand	Research	2040	03	0603005A	1,078	1,672	12,012
Army	Combat Vehicle and Automotive Advanced Technology	This project matures and demonstrates advanced mobility and electric technologies for advanced propulsion power, and electrical components and subsystems to enable lightweight, agile, deployable, fuel efficient, and survivable ground vehicles.	Reduce Demand	Research	2040	03	0603005A	0	0	8,001
Army	Combat Vehicle and Automotive Advanced Technology	This project matures and demonstrates advanced mobility and electric technologies for advanced propulsion, power, and electrical components and subsystems to enable lightweight, agile, deployable, fuel efficient, and survivable ground vehicles.	Diversify Supply	Research	2040	03	0603005A	2,953	2,000	2,000
Army	Combat Vehicle and Automotive Advanced Technology	This project matures and demonstrates advanced mobility and electric technologies for advanced propulsion power, and electrical components and subsystems to enable lightweight, agile, deployable, fuel efficient, and survivable ground vehicles.	Reduce Demand	Research	2040	03	0603005A	989	5,357	25,364
Army	Combat Vehicle and Automotive Advanced Technology	This project matures and demonstrates advanced mobility and electric technologies for advanced propulsion power, and electrical components and subsystems to enable lightweight, agile, deployable, fuel efficient, and survivable ground vehicles.	Reduce Demand	Research	2040	03	0603005A	2,876	3,627	15,854
Army	Combat Vehicle and Automotive Advanced Technology	This project matures and demonstrates advanced mobility and electric technologies for advanced propulsion power, and electrical components and subsystems to enable lightweight, agile, deployable, fuel efficient, and survivable ground vehicles.	Reduce Demand	Research	2040	03	0603005A	3,529	2,664	14,947
Army	Combat Vehicle and Automotive Advanced Technology	This project matures and demonstrates advanced mobility and electric technologies for advanced propulsion power, and electrical components and subsystems to enable lightweight, agile, deployable, fuel efficient, and survivable ground vehicles.	Reduce Demand	Research	2040	03	0603005A	2,082	1,000	8,002
Army	Combat Vehicle and Automotive Advanced Technology	This project matures and demonstrates advanced mobility and electric technologies for advanced propulsion power, and electrical components and subsystems to enable lightweight, agile, deployable, fuel efficient, and survivable ground vehicles.	Reduce Demand	Research	2040	03	0603005A	530	0	0

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Army	Combat Vehicle and Automotive Advanced Technology	This project matures and demonstrates advanced mobility and electric technologies for advanced propulsion power, and electrical components and subsystems to enable lightweight, agile, deployable, fuel efficient, and survivable ground vehicles.	Reduce Demand	Research	2040	03	0603005A	2,582	2,778	14,588
Army	Combat Vehicle and Automotive Advanced Technology	This project matures and demonstrates advanced mobility and electric technologies for advanced propulsion, power, and electrical components and subsystems to enable lightweight, agile, deployable, fuel efficient, and survivable ground vehicles.	Diversify Supply	Research	2040	03	0603005A	2,405	1,500	7,002
Army	Combat Vehicle and Automotive Advanced Technology	This project matures and demonstrates advanced mobility and electric technologies for advanced propulsion power, and electrical components and subsystems to enable lightweight, agile, deployable, fuel efficient, and survivable ground vehicles.	Reduce Demand	Research	2040	03	0603005A	0	3,500	21,414
Army	Combat Vehicle and Automotive Advanced Technology	This project matures and demonstrates advanced mobility and electric technologies for advanced propulsion power, and electrical components and subsystems to enable lightweight, agile, deployable, fuel efficient, and survivable ground vehicles.	Reduce Demand	Research	2040	03	0603005A	0	10,000	54,014
Army	Combat Vehicle and Automotive Advanced Technology	This project matures and demonstrates advanced mobility and electric technologies for advanced propulsion power, and electrical components and subsystems to enable lightweight, agile, deployable, fuel efficient, and survivable ground vehicles.	Reduce Demand	Research	2040	03	0603005A	893	0	0
Army	Combat Vehicle and Automotive Advanced Technology	This project assesses the impact of using emerging alternative fuels in tactical/combat vehicles, tactical generator sets, and other deployable assets. This project also identifies and addresses potential changes needed in fuel specifications.	Reduce Demand	Research	2040	03	0603005A	7,500	250	250
Army	Combat Vehicle and Automotive Advanced Technology	This project matures and demonstrates advanced mobility and electric technologies for advanced propulsion power, and electrical components and subsystems to enable lightweight, agile, deployable, fuel efficient, and survivable ground vehicles.	Reduce Demand	Research	2040	03	0603005A	3,007	3,858	16,604
Army	Combat Veh. And Auto. Technology	Ground vehicle applied research in petroleum, oil and lubricant (POL) products that reduces logistic burdens, maintenance requirements, and fuel consumption.	Diversify Supply	Research	2040	02	0602601A	1,141	0	0
Army	Combat Vehicle and Automotive Technology	Ground vehicle applied research in electrical power systems--high temperature and efficient power generation components using high operating temperature switching devices and advanced electrical generation components.	Diversify Supply	Research	2040	02	0602601A	1,903	2,826	13,855
Army	Combat Vehicle and Automotive Technology	This project designs, develops, and evaluates a variety of innovative enabling technologies in the areas of vehicle concepts, virtual prototyping, electrical power, thermal management, propulsion, mobility, survivability, vehicle diagnostics, fuels, and lubricants.	Reduce Demand	Research	2040	02	0602601A	2,386	2,535	12,385

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Army	Combat Vehicle and Automotive Technology	This project designs, develops, and evaluates a variety of innovative enabling technologies in the areas of vehicle concepts, virtual prototyping, electrical power, thermal management, propulsion, mobility, survivability, vehicle diagnostics, fuels, and lubricants.	Reduce Demand	Research	2040	02	0602601A	3,113	3,052	12,495
Army	Combat Vehicle and Automotive Technology	This project designs, develops, and evaluates a variety of innovative enabling technologies in the areas of vehicle concepts, virtual prototyping, electrical power, thermal management, propulsion, mobility, survivability, vehicle diagnostics, fuels, and lubricants.	Reduce Demand	Research	2040	02	0602601A	2,417	1,328	6,465
Army	Combat Vehicle and Automotive Technology	This project funds the National Automotive Center (NAC), which was chartered by the Secretary of the Army to conduct shared government and industry (dual use) technology programs to leverage commercial investments in automotive technology research and development.	Reduce Demand	Research	2040	02	0602601A	10,950	11,402	58,271
Army	Combat Vehicle and Automotive Technology	This project funds the National Automotive Center (NAC), which was chartered by the Secretary of the Army to conduct shared government and industry (dual use) technology programs to leverage commercial investments in automotive technology research and development.	Reduce Demand	Research	2040	02	0602601A	4,081	4,238	21,978
Army	Combat Vehicle and Automotive Technology	This project designs, develops, and evaluates a variety of innovative enabling technologies in the areas of vehicle concepts, virtual prototyping, electrical power, thermal management, propulsion, mobility, survivability, vehicle diagnostics, fuels, and lubricants.	Reduce Demand	Research	2040	02	0602601A	2,759	2,705	14,295
Army	Combat Vehicle and Automotive Technology	This project designs, develops, and evaluates a variety of innovative enabling technologies in the areas of vehicle concepts, virtual prototyping, electrical power, thermal management, propulsion, mobility, survivability, vehicle diagnostics, fuels, and lubricants.	Reduce Demand	Research	2040	02	0602601A	961	3,369	17,643
Army	Combat Vehicle Improvement	More efficient Abrams-The Abrams Auxiliary Power Unit (APU) will generate an overall fuel savings of 3%.	Reduce Demand	Direct	2033	01	0211702A	0	0	22,000
Army	Combat Vehicle Improvement	More efficient Abrams-Research & Development effort to improve Abrams fuel efficiency by 3%.	Reduce Demand	Indirect	2040	07	0203735A	3,500	3,800	6,900
Army	Combat Vehicle Improvement	More efficient Bradley-The Bradley improved transmission generates an overall fuel reduction of 3%.	Reduce Demand	Direct	2033	01	0211702A	0	0	272,000
Army	Combat Vehicle Improvement	More efficient Bradley-Research & Development effort to improve Bradley fuel efficiency by 3%.	Reduce Demand	Indirect	2040	07	0203735A	9,100	11,600	17,500
Army	Combating Terrorism, Technology Development	AVPTA. Conducts Ground Vehicle Power Technology efforts with DoE	Reduce Demand	Research	2040	03	0603125A	0	5,076	26,213

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Army	Combating Terrorism, Technology Development	This project matures and demonstrates advanced mobility and electric technologies for advanced propulsion, power, and electrical components and subsystems to enable lightweight, agile, deployable, fuel efficient, and survivable ground vehicles.	Diversify Supply	Research	2040	03	0603125A	4,997	0	0
Army	Combating Terrorism, Technology Development	This project matures and demonstrates advanced mobility and electric technologies for advanced propulsion, power, and electrical components and subsystems to enable lightweight, agile, deployable, fuel efficient, fuel efficient, and survivable ground vehicles.	Reduce Demand	Research	2040	03	0603125A	0	4,000	16,000
Army	Contingency Base Infrastructure (CBI)	Optimize recommendations for materiel used to establish, maintain, and operate contingency basing.	Diversify Supply	Direct	2040	05	0604804A	0	983	9,859
Army	Defense Research Sciences	Identifies, advances, and enhances emerging power generation, energy storage, and power management components and software. This project funds research in electrochemistry, energy conversion, and signature suppression technologies.	Reduce Demand	Research	2040	01	0601102A	5,677	5,600	28,961
Army	Defense Research Sciences	Basic research in multi-scale modeling approach to investigate biological systems to develop biologically-inspired sensors as well as bio-inspired power generation and storage techniques.	Diversify Supply	Research	2040	01	0601102A	3,111	2,010	9,766
Army	Defense Research Sciences	Extramural basic research in Electromagnetics & Solid State Electronics.	Diversify Supply	Research	2040	01	0601102A	2,609	2,600	13,446
Army	Defense Research Sciences	Basic research to increase the performance of small air-breathing engines and power-trains for air and/or ground vehicles; new materials to withstand the higher temperature regimen; flow physics and the mechanical behavior tools.	Diversify Supply	Research	2040	01	0601102A	1,733	1,700	8,792
Army	Defense Research Sciences	Research includes nano-electronic devices; sensors, emissive nonlinear and nanophase electrodes, and electronic materials; thin heterostructure systems; battery materials, thermoelectric devices, photovoltaic and thermal photovoltaic devices, and fuel cells.	Reduce Demand	Research	2040	01	0601102A	2,034	2,300	11,059
Army	Defense Research Sciences	Basic research in non-linear ground vehicle control algorithms, using off-road terrain characteristics; and unique mobility approaches, using advanced analytical and experimental procedures.	Diversify Supply	Research	2040	01	0601102A	612	701	3,622
Army	Defense Research Sciences	Propulsion Energetics and Flight extramural basic research.	Diversify Supply	Research	2040	01	0601102A	2,583	3,000	14,398
Army	Defense Research Sciences	This project fosters research to increase the performance of small air-breathing engines and power-trains to support improved system mobility, reliability, and survivability for air and/or ground vehicles; and ultimately serve to reduce the logistics cost.	Reduce Demand	Research	2040	01	0601102A	2,520	2,408	12,439

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Army	Early Entry Fluid Distribution System (E2FDS)	More efficient fuel/non-potable water distribution in the battlespace.	Diversify Supply	Direct	2040	05	0604804A	1,400	4,700	19,800
Army	Electronics and Electronic Devices	This project designs and evaluates electronics and electronic components and devices for Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) applications and battlefield power and energy applications.	Reduce Demand	Research	2040	02	0602705A	1,192	1,140	5,795
Army	Electronics and Electronic Devices	Applied research in compact portable power sources.	Diversify Supply	Research	2040	02	0602705A	907	863	4,394
Army	Electronics and Electronic Devices	Applied research in compact, high-efficiency, high-temp, high-power component technologies (semiconductor, magnetic, and dielectric devices) for hybrid-electric propulsion, electric power generation and conversion, and smart/micro-grid power distribution.	Diversify Supply	Research	2040	02	0602705A	0	3,000	16,803
Army	Electronics and Electronic Devices	Identifies, advances, and enhances emerging power generation, energy storage, and power management components and software. This project funds research in electrochemistry, energy conversion, and signature suppression technologies.	Reduce Demand	Research	2040	02	0602705A	1,796	1,791	8,768
Army	Electronics and Electronic Devices	Applied research in soldier energy scavenging technology.	Diversify Supply	Research	2040	02	0602705A	0	1,568	12,219
Army	Electronics and Electronic Devices	This project designs and evaluates electronics and electronic components and devices for Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) applications and battlefield power and energy applications.	Reduce Demand	Research	2040	02	0602705A	2,807	2,784	14,175
Army	Electronics and Electronic Devices	Identifies, advances, and enhances emerging power generation, energy storage, and power management components and software. This project funds research in electrochemistry, energy conversion, and signature suppression technologies.	Reduce Demand	Research	2040	02	0602705A	2,544	2,000	10,000
Army	Electronics and Electronic Devices	Applied research electronic materials, structures, and components for higher energy density and efficiency required by future Army systems such as electromagnetic armor, directed energy weapons, power grid protection, and other pulsed-power systems.	Diversify Supply	Research	2040	02	0602705A	1,127	1,187	6,598
Army	Electronics and Electronic Devices	Applied research in soldier and portable power sources: batteries, fuel cells, generators.	Diversify Supply	Research	2040	02	0602705A	5,921	6,133	6,333
Army	Electronics and Electronic Devices	Applied research in reforming logistics fuel for fuel cell hydrogen.	Diversify Supply	Research	2040	02	0602705A	1,236	1,188	6,046

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Army	Electronics and Electronic Devices	Applied research in electronics and electronic components and devices for C4ISR applications and battlefield power and energy applications.	Diversify Supply	Research	2040	02	0602705A	1,344	1,375	7,000
Army	Electronics and Electronic Devices	Identifies, advances, and enhances emerging power generation, energy storage, and power management components and software. This project funds research in electrochemistry, energy conversion, and signature suppression technologies.	Reduce Demand	Research	2040	02	0602705A	0	2,000	10,000
Army	Electronics and Electronic Devices	Identifies, advances, and enhances emerging power generation, energy storage, and power management components and software. This project funds research in electrochemistry, energy conversion, and signature suppression technologies.	Reduce Demand	Research	2040	02	0602705A	628	599	8,884
Army	Electronics and Electronic Devices	Identifies, advances, and enhances emerging power generation, energy storage, and power management components and software. This project funds research in electrochemistry, energy conversion, and signature suppression technologies.	Reduce Demand	Research	2040	02	0602705A	739	10	6,034
Army	Electronics and Electronic Devices	Identifies, advances, and enhances emerging power generation, energy storage, and power management components and software. This project funds research in electrochemistry, energy conversion, and signature suppression technologies.	Reduce Demand	Research	2040	02	0602705A	933	0	0
Army	Electronics and Electronic Devices	Applied research on renewable power for remote/austere operational environments.	Diversify Supply	Research	2040	02	0602705A	1,053	0	0
Army	Electronics and Electronic Devices	Applied research on renewable power for remote/austere operational environments.	Diversify Supply	Research	2040	02	0602705A	1,982	0	0
Army	Electronics and Electronic Devices	Identifies, advances, and enhances emerging power generation, energy storage, and power management components and software. This project funds research in electrochemistry, energy conversion, and signature suppression technologies.	Reduce Demand	Research	2040	02	0602705A	1,796	3,620	3,620
Army	Electronics and Electronic Devices	Soldier transportable power source applied research.	Diversify Supply	Research	2040	02	0602705A	0	16	35,033
Army	Expeditionary Water Packaging System (EWPS)	EWPS provides localized production of bottle water.	Reduce Demand	Indirect	2040	05	0604804A	524	311	311
Army	Exp. Water Packing System (EWPS)	EWPS provides localized production of bottle water.	Diversify Supply	Direct	2035	03	0216300A	0	1,635	14,285

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Army	Force Provider	Improved Force Provider-Purchase of liners, shades, Light Emitting Diode (LED) lighting, micro-grids and shower water re-use systems to reduce fuel usage by 50% and water by 75%.	Reduce Demand	Direct	2035	03	0216300A	9,900	16,590	16,590
Army	Force Provider	Modifications to In-Service Equipment, Force Provider MoD 7-Purchase of liners, shades, doorways, micro-grids and Light Emitting Diodes (LED) lighting resulting in a 35% reduction in fuel demand.	Reduce Demand	Direct	2035	03	0216300A	31,430	30,070	119,331
Army	Force Provider	Base Camp Integration Lab (BCIL) Fort, Devens / Net Zero / Zero Footprint.	Reduce Demand	Direct	2040	05	0604804A	825	1,980	12,687
Army	Force Provider	Base Camp Integration Lab (BCIL), Fort Devens / Net Zero / Zero Footprint.	Reduce Demand	Direct	2040	04	0604804A	1,612	2,271	18,214
Army	Ground Soldier systems	Reduces battery requirement - Funds equipment for recharging batteries through alternative energy sources, buys improved batteries and funds more efficient chargers.	Reduce Demand	Direct	2040	05	0604827A	9,914	0	0
Army	HIPPO Water Distribution System	More efficient water distribution.	Reduce Demand	Direct	2035	03	0216300A	26,600	12,300	44,800
Army	Improved Aircraft Engine	More efficient helicopter engine-ITEP enters Milestone A in 1QFY14-Army expects 13% to 22% fuel reduction from current Blackhawk/Apache engines. Flies at higher altitudes, in hotter temperatures and increased range. 35% less maintenance cost.	Reduce Demand	Indirect	2040	07	0203744A	79,922	40,000	463,304
Army	Improved Environmental Control Unit (IECU)	Military air conditioners with supplemental heaters.	Reduce Demand	Direct	2040	05	0604804A	2,966	0	0
Army	Improved Environmental Control Unit (IECU)	Heaters and Improved Environmental Control Unit (IECU) Family.	Reduce Demand	Direct	2035	03	0604804A	0	9,235	85,817
Army	Improved Large Generator	Large Advanced Mobile Power Sources (LAMPS)	Reduce Demand	Direct	2035	03	0216300A	0	0	79,334
Army	Improved Large Generator	Large Advanced Mobile Power Sources (LAMPS).	Reduce Demand	Indirect	2040	05	0604804A	2,025	3,513	3,513
Army	Improved Power Distribution Illumination Systems Electrical (IPDISE)	More efficient power distribution	Reduce Demand	Research	2035	03	0216300A	0	0	79,488
Army	(IPDISE)	More efficient power distribution.	Reduce Demand	Direct	2040	05	0604804A	3,000	1,000	3,441

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Army	Improved Small Generator	Small Tactical Electric Power (STEP)	Reduce Demand	Direct	2040	05	0604804A	0	1,362	17,789
Army	Improved Small Generator	Small Tactical Electric Power (STEP)	Reduce Demand	Direct	2035	03	0216300A	0	0	123,075
Army	In-house Laboratory Independent Research	This project promotes research to increase the ground vehicles to support improved system mobility, reliability, and survivability for air and/or ground vehicles; and results in reduced logistics cost.	Diversify Supply	Research	2040	01	0601101A	1,219	1,500	7,758
Army	Joint Light Tactical Vehicle	More efficient light vehicle.	Reduce Demand	Indirect	2035	01	0216300A	1	17,300	266,200
Army	Joint Light Tactical Vehicle	More efficient light vehicle--20% improvement in stationary fuel consumption over the baseline Humvee (HMMWV).	Reduce Demand	Indirect	2040	05	0216300A	100	0	0
Army	Joint Operational Energy Initiative	Holistic approach to the evaluation of OE-related impacts, systems, and improvements.	Future Force		2040	04	0603804A	1,800	2,500	7,000
Army	Warfighter Advanced Technology	Matures, demonstrates and integrates light weight and multifunctional materials and components to provide effective personal protection, electronics connectivity and mission specific equipment while reducing physical weight, cognitive burden and sustainment burden.	Reduce Demand	Research	2040	03	0603001A	1,678	1,705	1,705
Army	Warfighter Advanced Technology	Evaluate innovative Soldier power and energy sources for small unit networked electronics to include high energy/power conformal battery, advanced wearable hybrid fuel cell, and multi-fueled man pack power source.	Diversify Supply	Research	2040	03	0603001A	0	0	2,043
Army	Warfighter Advanced Technology	Matures, demonstrates and integrates light weight and multifunctional materials and components to provide effective personal protection, electronics connectivity and mission specific equipment while reducing physical weight, cognitive burden and sustainment burden.	Reduce Demand	Research	2040	03	0603001A	0	0	8,155
Army	Warfighter Advanced Technology	Matures, demonstrates and integrates light weight and multifunctional materials and components to provide effective personal protection, electronics connectivity and mission specific equipment while reducing physical weight, cognitive burden and sustainment burden.	Reduce Demand	Research	2040	03	0603001A	0	0	6,929
Army	Modular Fuel System (MFS)	More efficient fuel distribution in the battlespace.	Reduce Demand	Direct	2035	03	0216300A	15,700	26,700	113,700
Army	Modular Fuel System (MFS)	More efficient fuel distribution in the battlespace.	Diversify Supply	Direct	2040	05	0604804A	0	800	800

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Army	Power Distribution Illumination Systems Electrical (PDISE)	More efficient power distribution.	Reduce Demand	Direct	2040	05	0604804A	125	16,058	34,665
Army	Soldier Power	Reduces Battery Requirement-Funds equipment for recharging batteries through alternative energy sources, buys improved batteries, and funds more efficient chargers.	Reduce Demand	Direct	2035	03	0211700A	10,640	8,777	43,154
Army	Stryker	More efficient Stryker, increased horse power, electrical output, upgraded suspension, and in-vehicle network.	Reduce Demand	Direct	2033	01	0211702A	0	0	1,042,794
Army	Stryker	More efficient Stryker, increased horse power, electrical output, upgraded suspension, and in-vehicle network.	Reduce Demand	Direct	2040	04	0603747A	49,963	95,431	252,570
Army	Weapons and Munitions Advanced Technology	Matures and demonstrates advanced technologies for future weapons power technology. The major effort under this project is the phased approach for mobile high power solid state laser (SSL) technology demonstrations.	Reduce Demand	Research	2040	03	0603004A	3,244	600	600
Army	Weapons and Munitions Advanced Technology	Matures and demonstrates advanced technologies for future weapons power technology. The major effort under this project is the phased approach for mobile high power solid state laser (SSL) technology demonstrations.	Reduce Demand	Research	2040	03	0603004A	0	2,938	9,960
Army	Weapons and Munitions Advanced Technology	Matures and demonstrates advanced technologies for future weapons power technology. The major effort under this project is the phased approach for mobile high power solid state laser (SSL) technology demonstrations.	Reduce Demand	Research	2040	03	0603004A	0	979	9,524
Army	Advanced Medium Mobile Power Source (AMMPS)	Purchase of the improved medium generator sets using 21% less fuel.	Reduce Demand	Direct	2035	03	0216300A	38,904	95,724	944,362
							TOTAL ARMY OE	526,726	651,843	5,382,662

**Table 8. Marine Corps FY 2015 Operational Energy Initiatives
(Dollars in Thousands)**

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Marines	Advanced Power Sources	Advanced Power Sources is a family of small power devices providing portable electric power for legacy/ future weapons, optics, sensors, medical, intel and comm systems. The family has multiple suites: USMC Standard Power Supplies, Radio Power Adaptors, Battery Mgmt and Sustainment Systems, Comm /Electronics batteries, Lead acid batteries, Battery Charger/Analyzers, Solar and Renewable Energy Systems, Mobile Electric Hybrid Power Systems, Emerging requirements involving standardizations, and Naval Lithium Battery Safety Program management.	Reduce Demand	Direct	1106	01	0203761M	924	8,221	9,582
Marines	Advanced Power Sources	Advanced Power Sources is a family of small power devices providing portable electric power for legacy/ future weapons, optics, sensors, medical, intel and comm systems. The family has multiple suites: USMC Standard Power Supplies, Radio Power Adaptors, Battery Mgmt and Sustainment Systems, Comm /Electronics batteries, Lead acid batteries, Battery Charger/Analyzers, Solar and Renewable Energy Systems, Mobile Electric Hybrid Power Systems, Emerging requirements involving standardizations, and Naval Lithium Battery Safety Program management.	Reduce Demand	Direct	1109	06	0206211M	8,618	2,185	53,309
Marines	Advanced Power Sources	Advanced Power Sources is a family of small power devices providing portable electric power for legacy/ future weapons, optics, sensors, medical, intel and comm systems. The family has multiple suites: USMC Standard Power Supplies, Radio Power Adaptors, Battery Mgmt and Sustainment Systems, Comm /Electronics batteries, Lead acid batteries, Battery Charger/Analyzers, Solar and Renewable Energy Systems, Mobile Electric Hybrid Power Systems, Emerging requirements involving standardizations, and Naval Lithium Battery Safety Program management.	Reduce Demand	Direct	1109	06	0502511M	4,393	1,910	11,122
Marines	Advanced Power Sources	Advanced Power Sources is a family of small power devices providing portable electric power for legacy/ future weapons, optics, sensors, medical, intel and comm systems. The family has multiple suites: USMC Standard Power Supplies, Radio Power Adaptors, Battery Mgmt and Sustainment Systems, Comm /Electronics batteries, Lead acid batteries, Battery Charger/Analyzers, Solar and Renewable Energy Systems, Mobile Electric Hybrid Power Systems, Emerging requirements involving standardizations, and Naval Lithium Battery Safety Program management.	Reduce Demand	Direct	1106	01	0206624M	137	146	150

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Marines	Advanced Power Sources	Advanced Power Sources is a family of small power devices providing portable electric power for legacy/ future weapons, optics, sensors, medical, intel and comm systems. The family has multiple suites: USMC Standard Power Supplies, Radio Power Adaptors, Battery Mgmt and Sustainment Systems, Comm /Electronics batteries, Lead acid batteries, Battery Charger/Analyzers, Solar and Renewable Energy Systems, Mobile Electric Hybrid Power Systems, Emerging requirements involving standardizations, and Naval Lithium Battery Safety Program management.	Reduce Demand	Direct	1319	07	0206624M	1,514	830	7,917
Marines	Advanced Power Sources	Advanced Power Sources is a family of small power devices providing portable electric power for legacy/ future weapons, optics, sensors, medical, intel and comm systems. The family has multiple suites: USMC Standard Power Supplies, Radio Power Adaptors, Battery Mgmt and Sustainment Systems, Comm /Electronics batteries, Lead acid batteries, Battery Charger/Analyzers, Solar and Renewable Energy Systems, Mobile Electric Hybrid Power Systems, Emerging requirements involving standardizations, and Naval Lithium Battery Safety Program management.	Reduce Demand	Direct	1106	03	0804771M	136	89	509
Marines	Advanced Tech Demo	Concepts for JP-8 Fuel Efficient Power Node (fuel Cell), Water Purification, and Energy Harvesting Backpack.	Reduce Demand	Research	1319	03	0603640M	3,500	4,500	21,555
Marines	Applied Research	Concepts for Flexible Photovoltaics for Integrated and deployable Systems, and UV-LED Water Purification-Energy efficient small unit water purification technologies (filtration, desalination, sanitation).	Reduce Demand	Research	1319	02	0602131M	1,279	1,321	7,157
Marines	Environmental Control Equipment	Family includes ECUs. Portfolio is horizontal/vertical configured MC Standard air conditioners. ECUs range from 9,000 to 120,000 BTUs for 50/60/400HZ. EECU provides ~17% increased efficiency across the portfolio of systems.	Reduce Demand	Indirect	1319	07	0206624M	1,983	435	3,056
Marines	Environmental Control Equipment	Family includes ECUs. Portfolio is horizontal/vertical configured MC Standard air conditioners. ECUs range from 9,000 to 120,000 BTUs for 50/60/400HZ. EECU provides ~17% increased efficiency across the portfolio of systems.	Reduce Demand	Indirect	1109	06	0206315M	3,956	633	4,968
Marines	Environmental Control Equipment	Family includes ECUs. Portfolio is horizontal/vertical configured MC Standard air conditioners. ECUs range from 9,000 to 120,000 BTUs for 50/60/400HZ. EECU provides ~17% increased efficiency across the portfolio of systems.	Reduce Demand	Indirect	1106	01	0206624M	201	53	297
Marines	Environmental Control Equipment	Family includes ECUs. Portfolio is horiz./vert. configured MC Standard air conditioners. ECUs range from 9,000 to 120,000 BTUs for 50/60/400HZ. EECU provides ~17% increased efficiency across the portfolio of systems.	Reduce Demand	Indirect	1109	06	0502514M	2,848	361	6,201

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Marines	Expeditionary Energy Office	Semi-Annual process to evaluate and deploy technologies to support Marine Corps Expeditionary Energy Strategy goals of increased combat effectiveness and reduced dependence on liquid logistics on the battlefield.	Future Force	Direct	1319	07	0206313M	2,128	2,671	11,618
Marines	Expeditionary Energy Office	USMC Senior Official for Operational Energy, Plans and Programs. Tasked by CMC to Analyze, develop, and direct the Marine Corps' energy strategy in order to optimize expeditionary capabilities across all Warfighting functions.	Future Force	Research	1106	04	0902498M	3,762	3,847	17,829
Marines	Family of Expeditionary Water Systems	Technology upgrades to increase potable water output while reducing system energy demands in order to provide expeditionary point of production water at mid to small forward operating bases, and while on the move. This will reduce resupply efforts.	Reduce Demand	Direct	1109	06	0206315M	5,100	589	8,887
Marines	Family of Expeditionary Water Systems	Technology upgrades to increase potable water output while reducing system energy demands in order to provide expeditionary point of production water at mid to small forward operating bases, and while on the move. This will reduce resupply efforts.	Reduce Demand	Direct	1109	06	0206315M	5,100	589	8,887
Marines	Family of Field Medical	Upgrades the 40 year old M-138 Field Sanitizer to more efficient model.	Reduce Demand	Indirect	1109	06	0206315M	1,790	0	0
Marines	Family of Shelters and Shelter Equipment	Improved R-values for GP Medium; decrease number of shelters by replacing 10-man Arctic with 15-man Arctic shelter; procure more efficient Space Heater Arctic. Also includes efforts to procure next generation lighting.	Reduce Demand	Direct	1106	01	0203761M	7,479	2,984	11,428
Marines	Family of Shelters and Shelter Equipment	R&D for future shelter systems and USMC lighting solution of the future.	Reduce Demand	Direct	1319	07	0206623M	300	250	1,250
Marines	Medium Tactical Vehicle Replacement (MTVR)	Through analysis, modeling and simulation, hardware development, integration, test, and evaluation, the Fuel Efficient Medium Tactical Vehicle Replacement (MTVR) FNC program will select, bench test, and integrate a suite of affordable fuel efficiency enabler.	Reduce Demand	Direct	1106	01	0702808M	201	0	8,686
Marines	Medium Tactical Vehicle Replacement (MTVR)	Through analysis, modeling and simulation, hardware development, integration, test, and evaluation, the Fuel Efficient Medium Tactical Vehicle Replacement (MTVR) FNC program will select, bench test, and integrate a suite of affordable fuel efficiency enabler.	Reduce Demand	Direct	1319	07	0206624M	2,411	479	8,404
Marines	Medium Tactical Vehicle Replacement (MTVR)	Through analysis, modeling and simulation, hardware development, integration, test, and evaluation, the Fuel Efficient Medium Tactical Vehicle Replacement (MTVR) FNC program will select, bench test, and integrate a suite of affordable fuel efficiency enablers.	Reduce Demand	Direct	1109	05	0206315M	1,000	469	27,179

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Marines	Mobile Power Equipment	The Family of Mobile Power Equipment is a family-of-systems to continuously procure, update, and replenish approximately 19,000 items of Mobile Tactical Power Generation & Distribution Equipment to include the AMMPS system, and 22 different TAMCNs. The Family consists of skid & trailer mounted tactical generators ranging from 2 to 200 kilowatts, Mobile Electric Power Distribution Systems, Floodlight Sets, Load Banks & Electrician's Tool Kits. This equipment is procured & fielded to provide electricity on the battlefield. Combat, combat support & combat service support units all require tactical power to operate weapons systems, C4I systems, medical & messing facilities, environmental control equipment, & water purification systems.	Reduce Demand	Direct	1109	06	0206315M	8,750	4,890	38,786
Marines	Mobile Power Equipment	The Family of Mobile Power Equipment is a family-of-systems to continuously procure, update, and replenish approximately 19,000 items of Mobile Tactical Power Generation & Distribution Equipment to include the AMMPS system, and 22 different TAMCNs. The Family consists of skid & trailer mounted tactical generators ranging from 2 to 200 kilowatts, Mobile Electric Power Distribution Systems, Floodlight Sets, Load Banks & Electrician's Tool Kits. This equipment is procured & fielded to provide electricity on the battlefield. Combat, combat support & combat service support units all require tactical power to operate weapons systems, C4I systems, medical & messing facilities, environmental control equipment, & water purification systems.	Reduce Demand	Direct	1106	01	0206624M	201	101	511
Marines	Mobile Power Equipment	The Family of Mobile Power Equipment is a family-of-systems to continuously procure, update, and replenish approximately 19,000 items of Mobile Tactical Power Generation & Distribution Equipment to include the AMMPS system, and 22 different TAMCNs. The Family consists of skid & trailer mounted tactical generators ranging from 2 to 200 kilowatts, Mobile Electric Power Distribution Systems, Floodlight Sets, Load Banks & Electrician's Tool Kits. This equipment is procured & fielded to provide electricity on the battlefield. Combat, combat support & combat service support units all require tactical power to operate weapons systems, C4I systems, medical & messing facilities, environmental control equipment, & water purification systems.	Reduce Demand	Direct	1319	07	0206624M	1,000	1,000	1,500
							TOTAL MARINES OE	63,611	37,964	261,901

**Table 9. Navy FY 2015 Operational Energy Initiatives
(Dollars in Thousands)**

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Navy	Air Energy Conservation Program	AIR ENCON. Develop, implement and sustain Aircraft Energy Conservation Program Office to identify, validate, disseminate and incentivize energy conservation best practices within the Naval Aviation community. Targets include culture, fueling, mission planning, and maintenance.	Reduce Demand	Direct	1319	04	0603724N	1,412	1,631	8,698
Navy	Alternative Fuels Program	This program develops technical data through the execution of laboratory, component, engine, fuel system, and weapon system tests, which evaluates the effects of changes in fuel chemistry and properties on the performance and reliability of Naval ship, aircraft, and fuel distribution systems.	Diversify Supply	Direct	1319	04	0603724N	7,649	11,899	63,804
Navy	Auditing, Modeling & Savings Analysis	OPLOG R&D with MSC will manage and conduct energy audits to analyze energy usage onboard ships, facilitate and optimize energy reduction methods, and analyze the alternatives to reduce energy costs. This data will feed into the ENCON Calibrated Baseline Model for each ship class. Once calibrated through audit data input, the model serves as an accurate and flexible tool to generate baseline energy usage profiles for various missions, load-outs, area or operations, and operating conditions. Projected to save approximately 18,000 barrels of fuel from FY10-FY20.	Reduce Demand	Direct	4557	04	0408042N	1,530	1,567	7,036
Navy	Aviation Energy Conservation RDTE	By optimizing aircraft trim configuration across a variety of flight conditions, a control algorithm developed by NASA Dryden was able to reduce F/A-18A fuel consumption by 3.5% across three test flights without negatively impacting transient performance. Technology transition efforts are focused on the F/A-18 E/F and E/A-18 G.	Reduce Demand	Direct	1319	04	0603724N	2,625	3,792	7,085
Navy	Aviation Energy Conservation RDTE	F-35 program seeks to validate 10-25% potential fuel savings through advanced flight management system capabilities: 1.) Mission Segment Fuel Savings (Optimum Launch & Recovery Profiles, Continuous Decent Approach, Cruise-Climb, Optimized Holding Pattern, etc.) 2.) Total Mission Fuel Minimization (In-flight Trajectory Optimization, Required Navigation Performance) 3.) Reclamation of Airspace Inefficiencies	Reduce Demand	Direct	1319	04	0603724N	2,144	0	14,259
Navy	Aviation Energy Conservation RDTE	Extending the engine nozzle by 5.25" could improve the nozzle gross thrust and reduce aircraft boat-tail drag (0.52% reduced fuel burn). Applies to the F-35 A/C variants only.	Reduce Demand	Direct	1319	04	0603724N	0	0	20,605

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Navy	Aviation Energy Conservation RDTE	This initiative will optimize the fuel efficiency of the F-35 engine with various technologies, including Advanced Technology HPC, Optimized Turbine Cooling, Advanced Technology HPT, Turbine Clearance Control, and Fuel Burn Optimized Control Mode. These technologies will be forward fit in F-35 Block 5 (2020) and beyond.	Reduce Demand	Direct	1319	04	0603724N	15,770	21,595	44,450
Navy	Aviation Energy Conservation RDTE	This initiative will optimize the fuel efficiency of the F-35 air vehicle with attention to the PTMS Pre-Flight Operational Mode, GPS Approach Capability, CTOL /CV Nozzle Optimization, and Subsystem Standby Modes. These technologies will be forward fit in F-35 Block 5 (2020) and beyond.	Reduce Demand	Direct	1319	04	0603724N	1,828	707	8,704
Navy	Avn Energy Conservation RDTE	F-35 program seeks to leverage F/A-18 Trim-Optimizing Flight Control investments to achieve a 1.8% reduction in surface control drag (15 nm mission radius improvement).	Reduce Demand	Direct	1319	04	0603724N	1,213	3,542	13,165
Navy	Aviation Energy Conservation RDTE	The aircraft energy conservation RDTE project identifies, evaluates, validates and advocates for implementation of energy savings initiatives for legacy aircraft by engaging technical experts from across Naval aviation, other services, allies industry, and academia.	Reduce Demand	Direct	1319	04	0603724N	1,726	0	17,625
Navy	Aviation Energy Conservation RDTE	Joint Mission Planning System (JMPS) and Optimum Path Aircraft Routing System (OPARS) mission planning environments will be updated with current aircraft performance and environmental data to optimize mission segment MAX RANGE altitude and airspeed.	Reduce Demand	Direct	1319	04	0603724N	1,007	1,169	1,169
Navy	Aviation Energy Conservation RDTE	P-8/ C-40. By implementing GPS-assisted 'Required Navigation Performance' approaches using existing avionics & software, compatible fleet aircraft can potentially realize 1-2% fuel savings over conventional radio-navigation directed approaches. These TRL-9 concepts are widely used in commercial applications.	Reduce Demand	Direct	1319	04	0603724N	678	694	694
Navy	Aviation S&T	Identify and mature critical, relevant variable/adaptive cycle system technologies for the next generation carrier-based aircraft that combine high performance with fuel efficiency.	Reduce Demand	Research	1319	03	0603123N	9,718	6,100	28,777
Navy	Aviation S&T	Identify and mature critical, relevant variable/adaptive cycle system technologies for the next generation carrier-based aircraft that combine high performance with fuel efficiency.	Reduce Demand	Research	1319	02	0602123N	7,654	3,305	3,305
Navy	Aviation S&T	Sea-Based Aviation NNR applied research efforts in Design, materials selection, fabrication, inspection and maintenance related to air-vehicle structures research	Reduce Demand	Research	1319	02	0602123N	9,417	7,059	32,704
Navy	Aviation S&T	The Propulsion focus area of the Sea-Based Aviation National Naval Responsibility will provide innovative research and technology in propulsion, power and thermal management-related fields including Energy-Efficient Processes and Subsystems for future Naval Avn needs	Reduce Demand	Research	1319	01	0601153N	2,241	2,042	9,356

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Navy	Aviation S&T	FNC. Design and develop advanced components and models using the technologies developed under Turbine Engine Materials Research. The advanced components are integrated into advanced demonstrator engines and validated through testing.	Reduce Demand	Research	1319	03	0603673N	734	0	0
Navy	Bow Bulb Optimization	Bow bulb optimization modifies the shape of the bow bulb by adding an appendage above the sonar dome on DDG class ships. This appendage reduces hull wave drag without increasing hull resistance, impinging on sonar operations or reducing maneuverability.	Reduce Demand	Direct	1810	01	0204228N	0	0	8,000
Navy	Directional Stability	Installation of two medium sized fixed fins will improve directional stability and could reduce power up to 13% and increase fuel efficiency by 3%.	Reduce Demand	Direct	1804	01	0204411N	0	1,100	2,200
Navy	ECU50	ECU-50. In anticipation of the replacement of aged environmental control equipment, which is an opportunity for technology refresh, NAVFAC was funded to execute a science and technology (6.3) program. New technologies sought have the potential to reduce the fuel consumption by 50% (50% objective/20% threshold) of expeditionary environmental control units used by NECC, BEACHGROUPS and SPECWAR in their camp/shelters. The NETTP proposal was developed by NAVFAC jointly with OPNAV N45E, and competed in the FY 2011 RDT&E Competition sponsored by OSD OEPP. The NETTP proposal was based on the science and technology concepts, competitively solicited/and compiled by the DOE Advanced Research Projects Agency (ARPA-E) Program for Building Energy Efficiency Through Innovative Thermodevices. The advanced technology concepts (now at TRL 3) will be demonstrated at Technology Readiness Level 6 by the DOE's ARPA-E and then transitioned for NAVFAC/CNO development to TRL7/8. NAVFAC NEPO will procure these Expeditionary High Efficiency ECU's for technology refresh through the replacement program for overage assets in the 2017-2020 time frame. This will help meet the OPNAV goal of 15% reduction in fuel.	Reduce Demand	Direct	1810	05	0204455N	0	0	7,810
Navy	Electric Ships Office Efficiency Initiatives	Advanced gas turbine to provide better fuel efficiency, meet requirements for advanced sensors and future weapons, reduce weight, and lower life cycle costs. Potentially, DDG-51 Flight III ships could be forward fit with three GTG rather than four. Supported initiatives include LM2500 modifications.	Reduce Demand	Indirect	1319	04	0603573N	10,165	5,691	23,966
Navy	Electric Ships Office Efficiency Initiatives	ESO responsible for developing Next Generation Integrated Power System (NGIPS) technology aboard Navy Ships to provide smaller, simpler, more affordable, and more capable power systems. Supported initiatives include Energy Storage for Single Generator Operations.	Diversify Supply	Direct	1319	04	0603573N	7,175	8,675	12,325

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Navy	Energy Conservation Broad Agency Announcement	NSWCCD's Energy Conservation (ENCON) Broad Agency Announcement (BAA) is intended to solicit industry, academia, and government agencies to discover new, cost-effective, and innovative ways of using energy through new equipment or technology. Projected to save approximately 94,000 barrels of fuel from FY10-FY20.	Reduce Demand	Direct	4557	04	0408042N	3,091	3,647	17,085
Navy	Energy Initi. Studies and Development	Researching, identifying, and developing energy saving initiatives to the point where they can be directly applied to ship-based environments.	Reduce Demand	Direct	4557	04	0408042N	915	1,019	10,979
Navy	Expeditionary Power Integration and Control (EPIC)	EPIC. The Naval Expeditionary Forces have a need for an Expeditionary Power Integration and Control (EPIC) System. The EPIC shall be comprised of components to integrate, manage, control, distribute, and store electric power. The EPIC shall provide an autonomous capability to intelligently integrate and control multiple generators of varying size through phase balancing, monitoring and metering, load shedding, and load adjustment. The system shall interface with a rechargeable energy storage system, allowing for uninterrupted power supply while power generation is secured. Additionally, the system will accept and control input from solar and other renewable power generation sub-systems. An initial product with two capacities is required; EPIC1 capable of providing up to 70 kW of continuous power output and EPIC2 capable of providing up to 120kW of continuous power output. Continuous output power capability is defined as equivalence to total diesel generator power input.	Reduce Demand	Direct	1810	05	0204455N	0	0	9,261
Navy	Expeditionary S&T	Improve the photovoltaic device and system efficiency for lightweight, low-cost PV power systems	Reduce Demand	Research	1319	02	0602123N	1,000	1,000	5,000
Navy	Expeditionary S&T	Develop and demonstrate hydrogen powered fuel cells for small UAVs to address size, performance and endurance	Diversify Supply	Research	1319	02	0602123N	1,000	1,000	5,000
Navy	Expeditionary S&T	Conduct fundamental research to identify and investigate suitable materials for energy storage (e.g., advanced polymer, composite dielectric film, multi-layer glass-ceramic composite).	Diversify Supply	Research	1319	01	0601153N	2,700	2,240	11,639
Navy	Expeditionary S&T	FNC. 3-5kW tactical deployable thermal engine capable of utilizing existing and alternative fuels, and concentrated solar thermal energy	Reduce Demand	Research	1319	02	0602750N	1,070	1,164	1,677
Navy	Expeditionary S&T	FNC. 3-5kW tactical deployable thermal engine capable of utilizing existing and alternative fuels, and concentrated solar thermal energy	Reduce Demand	Research	1319	03	0603673N	1,802	2,192	3,987
Navy	Expeditionary S&T	Explore the use of one dimensional organic crystals to improve the performance of organic bulk heterojunction photovoltaics.	Reduce Demand	Research	1319	01	0601153N	85	0	0

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Navy	Expeditionary Trailer Mounted ECU/Generator (ETMEG)	A solution that reduces fuel requirements by procuring a trailer mounted unit consisting of a Commercial Off The Shelf generator and Environmental Control Unit mounted on a single axle trailer. This system is a higher efficiency system as compared to Navy Expeditionary Forces current Generator ECU Trailer (GET). In order to remain competitive, industry continues to develop and implement higher efficiency techniques. The ETMEG capability will be a self-contained system that consists of a Collective Protection approved ECU, and diesel generator, both mounted on a modified mobile utility trailer based on the standard M-Series single axle trailer chassis. This unit is expected to cut fuel requirements 20% from current burn rates.	Reduce Demand	Direct	1810	05	0204455N	2,085	708	18,986
Navy	Fleet Readiness R&D Program	FRR&DP focuses on technologies that can be quickly transitioned to increase energy efficiency and reduce maintenance costs. Includes T&E of various initiatives, as well as Smart Voyage Planning Decision Aid and Energy Dashboard. SVPDA is software for Naval Maritime Forecast Centers that uses local weather, current, hull form, and propulsion data to plan fuel efficient voyage routes. Energy Dashboard is a ship-wide monitoring system that conveys the power usage of numerous systems underway and in-port.	Reduce Demand	Indirect	1319	04	0603724N	7,695	17,905	69,510
Navy	Fuels S&T	Determine the viability of alternative fuels derived from biomass and waste sources for naval gas turbine and diesel engine operations.	Diversify Supply	Research	1319	02	0602123N	2,000	2,000	10,000
Navy	Fuels S&T	Accelerate the adoption of biofuels and blended logistic fuels by supporting Navy certification process, and understand and mitigate the impact of emerging fuels on naval power systems and operations.	Diversify Supply	Research	1319	01	0601153N	1,250	1,250	6,250
Navy	Fuels S&T	Accelerate the adoption of biofuels and blended logistic fuels by supporting Navy certification process, and understand and mitigate the impact of emerging fuels on naval power systems and operations.	Diversify Supply	Research	1319	02	0602123N	2,500	2,500	12,500
Navy	Fuels S&T	Studies microbial physiology mechanisms that mediate electrosynthesis (use of electrical current as an electron donor for metabolic processes) and novel bioengineering tools and strategies for enabling microbes to detect and produce physical and/or chemical signals.	Diversify Supply	Research	1319	01	0601153N	300	300	1,500
Navy	Fuels S&T	Studies microbial physiology mechanisms that mediate electrosynthesis (use of electrical current as an electron donor for metabolic processes) and novel bioengineering tools and strategies for enabling microbes to detect and produce physical and/or chemical signals.	Diversify Supply	Research	1319	02	0602236N	0	150	750

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Navy	Fuels S&T	YIP. Investigation of the ignition and oxidation chemistry for next-generation bio-derived Navy fuel blends in a novel rapid compression machine specifically designed for testing of heavy oxygenated fuels with low vapor pressure.	Diversify Supply	Research	1319	01	0601153N	85	0	0
Navy	HVAC&R Efficiency Improvement	Implementation of automating plant control systems, matching plant generation to demand, and using Variable Air Volume design; HVAC&R plants can be made efficient through a range of conditions and still retain the full maximum capacity. Examples of initiatives include T-AKE Intelligent HVAC, Endocube and the implementation of intelligent HVAC on other ship classes. Combined with same "HVAC&R Efficiency Improvement" BA Code 04, projected to save approximately 376,000 barrels of fuel from FY10-FY20.	Reduce Demand	Indirect	4557	02	0408042N	8,197	6,385	16,241
Navy	HVAC&R Efficiency Improvement	Design and research of ways of automating plant control systems, matching plant generation to demand, and using Variable Air Volume design; HVAC&R plants can be made efficient through a range of conditions and still retain the full maximum capacity. Examples of HVAC&R initiatives include T-AKE Intelligent HVAC, Endocube and the implementation of intelligent HVAC on other ship classes. Combined with same "HVAC&R Efficiency Improvement" BA Code 02, projected to save approximately 376,000 barrels of fuel from FY10-FY20.	Reduce Demand	Direct	4557	04	0408042N	779	470	3,619
Navy	Hybrid Electric Drive Implementation	Funds HED shipsets to include the propulsion motors, motor drives and the associated controls, interfaces, and mounting equipment that will be required to install the HED on DDG 51 Class Ships. This budget supports HED installation on DDG 51 Class in-service ships (backfit) beginning in FY16.	Reduce Demand	Direct	1810	01	0708017N	0	22,704	194,258
Navy	Hybrid Electric Drive Implementation	Funds the completion of Engineering Development Model and of First Article including contract award, design, manufacturing, and delivery. Completion of Factory Acceptance Test and performance testing in Land Based Engineering Site. Commencement, completion, delivery and installation of Low Rate Initial Production units to achieve fuel efficiency and increase on-station time.	Reduce Demand	Direct	1319	05	0604567N	0	7,949	38,006
Navy	Improved Environmental Control Unit (IECU)	IECU. Replacement of ECUs with units that incorporate variable speed fan drives and multi-frequency drive components which are ~20% more energy efficient.	Reduce Demand	Indirect	1810	05	0204455N	592	16	32

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Navy	Improved Metering and Monitoring	Installation of fuel meters and shore power meters. This fuel metering technology corrects for density, technology, and air entrainment and can thereby measure flow to an accuracy of around 0.01% error. A Shore Power Monitor stores energy and power quality data including cumulative kWh, peaks, and several power quality metrics. The compiled data enables MSC to monitor and manage shore power usage and implement appropriate energy conservation measures. The combination of these meters will feed into an Energy Dashboard that monitors real time energy usage, enabling ship operators to make operational changes that decrease overall energy usage.	Reduce Demand	Indirect	4557	02	0408042N	1,763	1,502	3,562
Navy	Improved Metering and Monitoring	Design of work packages for fuel meters and shore power meters. This fuel metering technology corrects for density, technology, and air entrainment and can thereby measure flow to an accuracy of around 0.01% error. A Shore Power Monitor stores energy and power quality data including cumulative kWh, peaks, and several power quality metrics. The compiled data enables MSC to monitor and manage shore power usage and implement appropriate energy conservation measures. The meters feed into an Energy Dashboard that monitors real time energy usage, enabling ship operators to make operational changes that decrease overall energy usage.	Reduce Demand	Indirect	4557	04	0408042N	390	313	1,171
Navy	Integrated Condition Assessment System (ICAS)	The Integrated Condition Assessment System (ICAS) enables review of hull, mechanical, and electrical data ashore. It consists of software, portable data terminals (PDTs), and workstations. ICAS will interface with the Energy Dashboard under development by the Fleet Readiness R&D Program.	Reduce Demand	Direct	1810	01	0204228N	2,077	2,173	6,506
Navy	LCAC Efficiency Improvements	In conjunction with the LCAC Service Life Extension Program (SLEP), multiple efficiency upgrades are being investigated for the platform, including torque meters and active shaft balancing. Successful initiatives will be installed as the units are upgraded through SLEP.	Reduce Demand	Indirect	1319	07	0204413N	3,130	2,807	9,032
Navy	Lighting Upgrades	Upgrade installed lighting with newer technologies to increase energy efficiency. Includes using T8 fluorescent bulbs, Light Emitting Diode (LED) technology, installing light switches and intelligent lighting technology such as motion and occupancy sensors. Projected to save approx. 170,000 barrels of fuel from FY10-FY20.	Reduce Demand	Direct	4557	02	0408042N	1,812	1,055	3,600
Navy	LM2500 Efficiency Implementation	The LM2500 R&D Program will modify the engine controller; reduce leak paths in the LM2500 compressor; reduce flow losses in the air intake and exhaust ducts; improve hot section; improve depot repair standards; investigate energy recovery strategies and automate gas turbine on-line water wash.	Reduce Demand	Indirect	1810	01	0204228N	0	0	6,370

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Navy	Maritime S&T	FNC. Develop a compact axial-flow waterjet (21-22 MW size) and demonstrate on a Littoral Combat Ship (LCS).	Reduce Demand	Research	1319	03	0603673N	460	0	0
Navy	Maritime S&T	FNC. Develop a pitch-adapting composite submarine propeller with a flexible tip for pitch adaptation, and blade-to-hub joint for modularity and replaceability.	Reduce Demand	Research	1319	02	0602750N	150	259	259
Navy	Maritime S&T	FNC. Develop a pitch-adapting composite submarine propeller with a flexible tip for pitch adaptation, and blade-to-hub joint for modularity and replaceability.	Reduce Demand	Research	1319	03	0603673N	1,290	1,418	1,618
Navy	Maritime S&T	Develop and demonstration novel UUV power systems to enable long endurance missions.	Reduce Demand	Research	1319	02	0602123N	4,852	5,047	15,964
Navy	Maritime S&T	FNC. Develop and demonstrate a common scalable architecture for naval and mobile expeditionary systems. Array developed and System Integration FY12; Final test and demonstration in FY13; Transition to PEO IWS FY14.	Reduce Demand	Research	1319	03	0603673N	1,195	500	500
Navy	Maritime S&T	FNC. Develop and demonstrate a long endurance, scalable air independent energy storage solution for undersea vehicles to support long complex multi-mission scenarios	Reduce Demand	Research	1319	02	0602750N	2,974	2,952	3,664
Navy	Maritime S&T	FNC. Develop and demonstrate a long endurance, scalable air independent energy storage solution for undersea vehicles to support long complex multi-mission scenarios	Reduce Demand	Research	1319	03	0603673N	2,142	4,065	6,914
Navy	Maritime S&T	Elucidate/optimize marine microbes and mechanisms responsible for electron transfer to anodes (in sediments) and cathodes (in overlying water) and configure electronics to allow practical powering of low-power devices.	Diversify Supply	Research	1319	02	0602236N	750	750	3,000
Navy	Maritime S&T	FNC. An integrated system that provides corrosion protection and fouling control, and threat detection.	Reduce Demand	Research	1319	02	0602750N	1,103	558	768
Navy	Maritime S&T	FNC. An integrated system that provides corrosion protection and fouling control, and threat detection.	Reduce Demand	Research	1319	03	0603673N	1,788	1,003	1,844
Navy	Maritime S&T	Explore design concepts for advanced power distribution, including multifunctional power controllers, electronic decoupling concepts, adaptive and reconfigurable power technology, and high power switching and pulse forming networks.	Reduce Demand	Research	1319	01	0601153N	2,901	2,442	12,573
Navy	Maritime S&T	A consortium of virtually linked academic institutions with hardware-in-the-loop capability coupled with physics based models for system design, testing, and validation.	Reduce Demand	Research	1319	02	0602123N	10,365	9,094	46,572
Navy	Maritime S&T	Develop and demonstrate improved power conditioning technologies for high pulse load energy management	Reduce Demand	Research	1319	02	0602114N	6,500	3,996	6,111
Navy	Maritime S&T	Develop and demonstrate novel power generation, energy storage and efficiency technologies	Reduce Demand	Research	1319	02	0602123N	1,000	1,000	5,000

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Navy	Maritime S&T	Investigate, develop and/or evaluate and demonstrate alternative energy and energy efficiency technologies; and support STEM and Veteran/Wounded Warrior energy education pilot program	Reduce Demand	Research	1319	02	0602123N	7,146	4,679	25,262
Navy	Maritime S&T	Understand fundamental chemistry, physics and the effects of scale. Develop novel materials and architectures for energy storage and novel materials to enable energy transformation processes. Synthesis of novel polymer and composite dielectric materials and optimization of discharge rates.	Reduce Demand	Research	1319	01	0601153N	2,715	2,190	11,395
Navy	Maritime S&T	FNC. Fundamental studies and physics-based models of evaporative cooling, including heat transfer and critical heat flux.	Reduce Demand	Research	1319	01	0601153N	2,005	1,643	8,413
Navy	Maritime S&T	FNC. Develop and demonstrate high speed, medium voltage direct current circuit breakers for ship power distribution system	Reduce Demand	Research	1319	02	0602750N	847	1,860	7,135
Navy	Maritime S&T	Develop/ demonstrate high speed, medium voltage direct current circuit breakers for ship power distribution system	Reduce Demand	Research	1319	03	0603673N	953	2,440	11,615
Navy	Maritime S&T	Develop high endurance power and air-independent propulsion for UUVs.	Reduce Demand	Research	1319	02	0602747N	6,900	6,600	18,700
Navy	Maritime S&T	Elucidate/optimize marine microbes and mechanisms responsible for electron transfer to anodes (in sediments) and cathodes (in overlying water) and configure electronics to allow practical powering of low-power devices.	Diversify Supply	Research	1319	01	0601153N	700	700	1,200
Navy	Maritime S&T	Explore design concepts for advanced power distribution. Multifunctional power controllers, electronic decoupling concepts, adaptive and reconfigurable power technology, and high power switching and pulse forming networks.	Reduce Demand	Research	1319	02	0602123N	911	796	3,978
Navy	Maritime S&T	Conduct fundamental research to identify and investigate suitable materials for energy storage (e.g., advanced polymer, composite dielectric film, multi-layer glass-ceramic composite).	Diversify Supply	Research	1319	01	0601153N	1,969	1,615	8,391
Navy	Maritime S&T	Conduct fundamental research to identify and investigate suitable materials for energy storage (e.g., advanced polymer, composite dielectric film, multi-layer glass-ceramic composite).	Diversify Supply	Research	1319	01	0601153N	2,800	2,305	11,979
Navy	Maritime S&T	Conduct fundamental research to identify and investigate suitable materials for energy storage (e.g., advanced polymer, composite dielectric film, multi-layer glass-ceramic composite).	Diversify Supply	Research	1319	01	0601153N	1,870	1,523	7,916
Navy	Maritime S&T	Understand and investigate novel approaches to managing high power/energy shipboard systems	Reduce Demand	Research	1319	01	0601153N	3,442	3,459	17,557
Navy	Maritime S&T	Understand and investigate novel approaches to managing high power/energy shipboard systems	Reduce Demand	Research	1319	02	0602123N	1,247	1,267	6,561
Navy	Maritime S&T	Understand and investigate novel approaches to managing high power/energy shipboard systems	Reduce Demand	Research	1319	02	0602782N	501	510	2,642

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Navy	Maritime S&T	The Propulsion focus area of the Sea-Based Aviation National Naval Responsibility will provide innovative research/ technology in propulsion, power and thermal management-related fields including Energy-Efficient Processes and Subsystems for future Naval Aviation.	Reduce Demand	Research	1319	02	0602123N	4,327	4,206	18,008
Navy	Maritime S&T	Provide design tools for high performance, efficient, low signature hull forms and propulsors and optimize integration of the hull-propulsor as a system.	Reduce Demand	Research	1319	01	0601153N	2,278	1,702	8,532
Navy	Maritime S&T	Provide design tools for high performance, efficient, low signature hull forms and propulsors and optimize integration of the hull-propulsor as a system.	Reduce Demand	Research	1319	02	0602123N	2,278	1,702	8,530
Navy	Maritime S&T	Develop and demonstrate high speed, long endurance undersea weapons	Reduce Demand	Research	1319	02	0602747N	1,638	1,300	6,500
Navy	Maritime S&T	YIP. Investigations of novel nano-engineered surfaces in order to understand fluidic and thermal transport processes during phase-change heat transfer. Experiments and modeling will be used to determine how various parameters of the nanostructured features affect the coupled heat and mass transport processes.	Reduce Demand	Research	1319	01	0601153N	170	78	78
Navy	Policy Guidance & Development and Training & Incentive Program	Implementing class-wide or fleet-wide policy that can result in more efficient ship operation. Integrating energy efficiency training into existing Civilian Mariner Engineering Officer (CMEO) Training program. Implementing an incentive program to incentivize efficient ship operation and the generation of energy conservation initiatives. Combined with same "Policy Guidance & Development and Training & Incentive Program" BA Code 04, projected to save approximately 10,000 barrels of fuel from FY10-FY20.	Reduce Demand	Direct	4557	02	0408042N	519	317	849
Navy	Policy Guidance & Development and Training & Incentive Program	Developing class-wide or fleet-wide policy that can result in more efficient ship operation. Integrating energy efficiency training into existing CMEO Training program. Developing an incentive program to incentivize efficient ship operation and the generation of energy conservation initiatives. Combined with same "Policy Guidance & Development and Training & Incentive Program" BA Code 02, projected to save approximately 10,000 barrels of fuel from FY10-FY20.	Reduce Demand	Direct	4557	04	0408042N	524	549	2,567
Navy	Propeller Coatings	An easy-release propeller coating system allows amphibious ships with long pier-side periods to shed propeller bio-fouling once underway. This technology is currently achieving fuel savings for MSC ships and the commercial shipping industry.	Reduce Demand	Direct	1804	01	0204411N	200	0	300

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Navy	Pump & Motor Efficiency Improvements	Implementing the use of variable speed technology to increase the efficiency of existing pumps and motors to better match actual demand. Also installing newer, more efficient pump and motor options. Combined with same "Pump & Motor Efficiency Improvements" BA Code 04, projected to save approximately 126,000 barrels of fuel from FY10-FY20.	Reduce Demand	Direct	4557	02	0408042N	3,787	1,698	3,220
Navy	Pump & Motor Efficiency Improvements	Research and development of variable speed technology to increase the efficiency of existing pumps and motors to better match actual demand. Also research the installation of newer, more efficient pump and motor options. Combined with same "Pump & Motor Efficiency Improvements" BA Code 02, projected to save approximately 126,000 barrels of fuel from FY10-FY20.	Reduce Demand	Indirect	4557	04	0408042N	312	0	0
Navy	Route Planning & Optimization	Implementing route planning programs, such as the Replenishment At Sea Planner (RASP), that can improve MSC's scheduling of ships between ports and underway combatant customer ships, thereby reducing fuel consumption. Once underway, ship optimization tools can be used to optimize the ship's equipment to further reduce fuel consumption. Combined with same "Route Planning & Optimization" BA Code 04, projected to save approximately 297,000 barrels of fuel from FY10-FY20.	Reduce Demand	Direct	4557	02	0408042N	475	480	3,603
Navy	Route Planning & Optimization	Developing route planning programs, such as the Replenishment At Sea Planner (RASP), that can improve MSC's scheduling of ships between ports and underway combatant customer ships, thereby reducing fuel consumption. Once underway, ship optimization tools can be used to optimize the ship's equipment to further reduce fuel consumption. Combined with same "Route Planning & Optimization" BA Code 02, projected to save approximately 297,000 barrels of fuel from FY10-FY20.	Reduce Demand	Direct	4557	04	0408042N	446	448	2,095
Navy	Shipboard Energy Dashboard	Energy Dashboard uses the Integrated Condition Assessment System (ICAS) to collect data from shipboard equipment. It includes the Fuel Management System (FMS), which assists pre-underway planning by recommending efficient equipment lineups. Energy Dashboard calculates and instantly displays daily energy consumption rates.	Reduce Demand	Direct	1810	01	0204228N	0	1,000	8,700
Navy	Shipboard Incentivized Energy Conservation Program	The Shipboard Incentivized Energy Conservation Program (i-ENCON) provides ships with operational techniques to reduce fuel consumption. Naval Sea Systems Command provides ships with the necessary training, tools and guidance that help to increase ships' underway operating hours for improved fleet readiness.	Reduce Demand	Direct	1804	04	0708017N	600	600	3,034

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
Navy	Simulator Upgrades	The Navy Aviation Simulator Master Plan (NASMP) identified capability (fidelity) and capacity upgrades required to maximize T&R simulation for F/A-18E/F, EA-18G, and MH-60R/S aircraft given fiscal, technological, and minimum flight time limitations.	Reduce Demand	Indirect	1506	07	0804743N	66,030	69,341	366,755
Navy	Solid State Lighting (Amphibs)	Replacement of existing incandescent lighting fixtures on amphibious ships with LED lights that will increase efficiency and operate for a much longer service life.	Reduce Demand	Direct	1810	01	0204411N	3,400	3,500	17,465
Navy	Solid State Lighting (CRUDES)	Replacement of existing incandescent lighting fixtures on surface combatants with LED lights that will increase efficiency and operate for a much longer service life.	Reduce Demand	Direct	1810	01	0204228N	3,000	4,500	12,200
Navy	Stern Flaps (Amphibs)	Develop and install stern flaps on LHD 1 and LSD 41/49 class ships. A stern flap was previously modeled and designed for LHD 8 and is directly applicable to LHD 1 class ships. LSD 41/49 would utilize same basic design as LHD 1.	Reduce Demand	Direct	1804	01	0204411N	1,000	0	2,500
Navy	Thermal Management Control System (TMCS)	Utilizing a centralized control system, which gathers information compartment by compartment and provides the appropriate conditioning for the compartment, the TMCS could determine the required number and location of AC plants best able to cool the area.	Reduce Demand	Direct	1810	01	0204228N	4,426	6,745	40,445
Navy	Triton Fuel Penalty Tool	This initiative will develop, install and optimize a system capable of reporting in real time when a ship's powering condition has degraded due to increased drag from biofouling. The system will provide data to the Energy Dashboard to report the fuel penalty produced by hull and propeller fouling, at a confidence level of 95%. Understanding of the fouling condition could influence cleaning frequency and increase efficiency.	Reduce Demand	Indirect	1810	01	0204228N	0	0	7,225
Navy	Variable Speed Drive (VSD) Collective Protection System (CPS)	This system uses an efficient variable speed drive in the CPS to reduce energy consumption by allowing the system to operate in states other than fully on or off.	Reduce Demand	Indirect	1810	01	0204228N	0	2,100	11,698
Navy	Variable Speed Drive (VSD) Port Use Fan (PUF)	Modernization of the operation of the PUF provides ships a reliable alternative to operating the FDBs while in-port steaming. This modification will facilitate the use of the PUF with a variable speed drive (VSD) to throttle the speed of the PUF as needed to provide proper combustion air while keeping the PUF vanes wide open. This modification will greatly improve efficiency and reduce fuel consumption while steaming in port.	Reduce Demand	Indirect	1804	01	0204411N	0	965	1,765
							TOTAL NAVY OE	297,890	328,919	1,575,858

**Table 10. Defense-Wide FY 2015 Operational Energy Initiatives
(Dollars in Thousands)**

ORG	OE Program Title	OE Project Description	Objective	OE Initiative	Treas Code	BA Code	Program Element	FY 2014	FY 2015	FYDP
DLA	Battery Network (BATTNET)	BATTNET is focused on improving the supply and reducing the costs of batteries used in fielded weapon systems.	Diversify Supply	Direct	0400	07	0708011S	1,876	2,002	10,373
DLA	Energy Readiness Program	Energy Readiness program (ERP) supports Alternative Energy Development to include test and certification to support the addition of synthetic and alternative fuels to mobility fuel specifications.	Diversify Supply	Direct	0400	03	0603712S	2,038	1,743	9,050
USD ATL	Operational Energy Capability Improvement	P456 Hybrid Energy Storage Module (HESM)	Reduce Demand	Research	0400	03	0604055D8 Z	14,913	0	0
USD ATL	Operational Energy Capability Improvement Fund (OECIF)	P455 Operational Energy Capability Improvement	Reduce Demand	Research	0400	03	0604055D8 Z	32,088	31,800	188,895
USD ATL	Operational Energy Plans & Programs (OEP&P)	Provides leadership and facilitation of communications & management oversight for OEPP within DoD. Coordinates Planning, Programming, Budgeting and Execution (PPBE) activities for DoD related to implementation of the operational energy strategy and monitors and reviews all operational energy initiatives within DoD.	Future Force	Direct	0100	04	0902198D8 Z	6,599	5,569	28,970
							TOTAL Defense Wide OE	57,514	41,114	237,288

Appendix C: Alternative Fuels Initiatives

This section is in response to the following requirement for the Operational Energy Annual Report as outlined in section 2925(b) of title 10, United States Code: *A description of the alternative fuel initiatives of the Department of Defense, including funding and expenditures by account and activity for the preceding fiscal year, including funding made available in regular defense Appropriation Acts and any supplemental Appropriation Acts.*

Table 11. Initiatives to Model and Develop Alternative / Non-Petroleum Fuel Feedstocks and Fuel Production Capabilities (Dollars in Thousands)

Service	Program Title	Initiative Title	Description	Treasury Code (TC)	Budget Activity (BA)	Budget Line Item	Program Element (PE)	FY 2015
Navy	NECO	Carbon Capture from Seawater	Develop and support the design and construction of a scaled-up carbon capture prototype that will produce enough carbon dioxide and hydrogen to make up to 1 gallon of fuel per day.	97X4930	020060658			350
Navy	Navy Energy	Navy Synthetic Fuel Production from Seawater	Assessment of the effects of reactor design on catalyst performance in laboratory-scale chemical reactors	97X4930	020060658			150
Navy		Naval Biosciences: Biosynthesis of Liquid Fuels	Develop transformational approaches using living organisms to produce fuel components (e.g., alkanes)	1319	01		0601153N	68
Navy		Biocentric Technology- Biosynthesis of Liquid Fuels	Develop transformational approaches using living organisms to produce fuel components (e.g., alkanes)	1319	02		0602236N	116
Subtotal								684

Table 12. Initiatives to Test and Evaluate Alternative / Non-Petroleum Fuels for Use in Military Fuel Systems¹⁷
(Dollars in Thousands)

Service	Program Title	Initiative Title	Description	Treasury Code (TC)	Budget Activity (BA)	Budget Line Item	Program Element (PE)	FY 2015
Air Force	Sweden Alcohol-To-Jet Fuel Processing and Performance		Develop the Alcohol-To-Jet (ATJ) aviation fuel process, produce a sufficient quantity of ATJ fuel to satisfy program requirements, and establish ATJ test and analysis requirements to enable a flight demonstration of a Gripen aircraft using a 50/50 blend of ATJ and JP-8.					500 ¹⁸
Army	Aviation Technology	Fuel Qualification and Certification Efforts	Assess the impact of using emerging alternative fuels in aviation platforms and identify changes in fuel specifications to implement alternative fuels into Army aviation systems.	2040	02	EM8	0602211A	\$0
Army	Combat Vehicle and Automotive Advanced Technology	Fuel Qualification and Certification Efforts	Assess the impact of using emerging alternative fuels in tactical/combat vehicles and other deployable assets, and will identify changes needed in fuel specifications to implement alternative fuels into Army systems.	2040	02	H77	0602601A	775
Navy	Mobility Fuels	Alternative Fuels Test and Qualification	Develop technical data through the execution of laboratory, component, engine, fuel system, and weapon system tests, which evaluates the effects of changes in fuel chemistry and properties on the performance and reliability of Naval ship, aircraft, and fuel distribution systems.	1319	04	0838	0603724N	10,745
DLA Energy	Quality/Technical Support Office – Energy Readiness Program	Effect of Alternative Jet Fuels on Combustor Operability Limits	This project is evaluating specific alternative fuel samples in an auxiliary power unit (APU) combustor rig to develop an understanding of alternative fuel composition effects on combustor operability, particularly pertaining to criteria of engine lean blow out and altitude relief. Air Force Research laboratory is performing this work as part of a larger joint Air Force/FAA initiative, the National Jet Fuel Combustion Program	0400	03		0603712S	500
Subtotal								12,520
Total Budgeted / Obligated in FY 2015								13,204

¹⁷ These initiatives include the procurement of alternative fuels to support testing and evaluation activities.

¹⁸ Estimate of non-financial contributions (e.g., salaries, background information, use of equipment)

**Table 12. Initiatives to Test and Evaluate Alternative /
Non-Petroleum Fuels for Use in Military Fuel Systems¹⁷**
(Dollars in Thousands)

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Army	Aviation Technology	Fuel Qualification and Certification Efforts	Assess the impact of using emerging alternative fuels in aviation platforms and identify changes in fuel specifications to implement alternative fuels into Army aviation systems.	2040	02	EM8	0602211A	\$0
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Subtotal								12,520
Total Budgeted / Obligated in FY 2015								13,204

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¹⁸ Estimate of non-financial contributions (e.g., salaries, background information, use of equipment)

Appendix D: Recommended Changes in Organization or Authority

At this time, the Department has no recommendations for changes in organization or authority.