NAVY EXPEDITIONARY COMBAT COMMAND
15 YEAR ENERGY STRATEGY

October 2010

Promulgation Letter

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The 2010 NECE Strategic Plan tasked the NECC staff and all subordinate commands to implement common processes that provide energy efficiency of the force. This Energy Strategy provides a roadmap to deliver NECC operational capability with less reliance on high cost or inefficient energy sources. Due to increased pressures on available DoD funding, we must become more efficient without reducing operational effectiveness.

Not only does increased efficiency and reduced consumption meet the Secretary of the Navy's (SECNAV) energy goals, it is the right thing to do. I challenge you to seek out creative ways to do your part to ensure we meet the SECNAV's goals.

Michael P Tillotson

RADM Michael P. Tillotson
Commander, NECC

EXECUTIVE SUMMARY

At the October 2009 Naval Energy Forum, the SECNAV set an energy goal that by 2020, half of the Navy's total energy consumption, ashore and afloat, will come from alternative sources. In addition, the Office of the Chief of Naval Operations' (OPNAV's) Task Force Energy – Expeditionary (TFE-E) has two energy goals for Navy Expeditionary Units for 2020:

(1) Reduce fuel consumption by 15% by changing how equipment is used.

(2) Increase fuel efficiency of end items by 15% when compared to FY 2008 baseline.

As a result, the Navy Expeditionary Combat Enterprise (NECE) Strategic Plan 2010 Initiative 3.4 (Tactical Energy Security) tasked the Navy Expeditionary Combat Command (NECC) to **"develop a NECC 15-year strategy to meet the Navy's goals to reduce energy consumption, improve energy efficiency, and increase alternative energy use in the expeditionary forces."** This energy strategy provides near, mid, and long term actions for NECC to meet SECNAV goals while maintaining mission capabilities.

The reduction in fuel usage will enable NECC to:

(1) Reduce the number of convoys to Forward Operating Bases (FOBs) delivering the following increases in:

a. Reduce military casualties and cargo losses.

b. Reduce logistics burden and increase military effectiveness.

(2) Meet energy reduction goals or mandates.

(3) Reduce reliance on foreign fossil fuel.

(4) Reduce greenhouse gas and other harmful exhaust emissions.

The focuses of the NECC 15 Year Energy Strategy will be on increasing energy efficiency for equipment, increasing alternative energy use in expeditionary operations, and changing how equipment is used in expeditionary operations.

Both increasing energy efficiency of equipment and using more alternative energy will require significant investments in the acquisition of new and/or modifying existing equipment. Research, Development, Test and Evaluation (RDT&E) may be required for significant improvements. The use of alternative fuels in expeditionary operations will also depend on alternative fuel infrastructure available and the commitment of the Marine Corps and other services to using alternative fuels for their deployed equipment. This is because NECC forces operate in joint environments and, in most contingency environments, depend on the joint forces for theater fuel supplies.

In expeditionary operations, changing equipment usage may lower energy consumption by

(1) Implementing behavioral, operational and procedural changes.

(2) Developing/using hardware and software for equipment to work together.

(3) Changing doctrine for deployed units and separate..

(4) Developing/using/modifying software for command and control of logistics processes.

The near term energy strategy (Fiscal Year (FY) 2011 to 2015) includes a focus on efficiency and reduction in fuel usage through operational and procedural changes and development of a fuel usage baseline and methods to measure fuel. To increase efficiency, NECC, through its Systems Commands (SYSCOMs), will acquire modern, energy efficient equipment when replacing current assets within affordability limitations. For example, using high efficiency Environmental Control Units (ECUs) and Light Emitting Diode (LED) lighting for forward operating bases will reduce the total energy consumption. Additionally, providing energy conservation training to personnel, such as shutting down unneeded equipment, will reduce fuel consumption. Alternative fuels remain in RDT&E/developmental phases and will not be available in sufficient quantities in the near term. In addition, NECE is specifically monitoring and working with various DoD components and private industry on RDT&E to use alternative fuels on both inboard and outboard boat motors.

The mid term energy strategy (FY 2016 to 2020) is to focus on top fuel consumers and encourage the development of advanced technologies for higher levels of energy efficiency and fuel usage reduction while integrating advanced technologies in warfare and logistics capabilities. NECC's vision requires carefully planned RDT&E in the acquisition process. Test and evaluation will validate suitability and reduce risks for NECC. Alternative fuels may be available in the mid term. NECC will continue to replace current assets with more energy efficient equipment.

The long term strategy (FY 2021 to 2025) is to continue to focus on top fuel consumers and encourage the advancement of technologies for higher levels of energy efficiency. This period will provide validation of initiatives implemented to meet SECNAV's 2020 energy requirement

Cost effectiveness and commonality of parts, equipment, systems and procedures with the Marine Corps and the joint forces are major objectives for NECC. NECC supporting SYSCOMs desire to partner with other services, joint commands, and DoD agencies to evaluate electric hybrid (without the use of battery pack for power storage), hybrid electric (with battery pack for power storage), alternative fuel, and/or multi-fuel vehicles before replacing the current generation of vehicles and construction equipment during Table of Allowance (TOA) refresh. For example, by using hybrid electric technology for the Medium Tactical Vehicle Replacements (MTVRs) and High Mobility Multipurpose Wheeled Vehicles (HMMWVs) (or its future replacement vehicle), NECC can reduce its total fuel consumption by about 10% per year. By following this energy strategy, NECC

is expected to meet the SECNAV and the OPNAV Task Force Energy goals by 2020 and continue to reduce energy consumption through FY 2025. Alternative energy and fuels will be inserted to the extent feasible operationally and logistically.

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INTRODUCTION

Navy Energy Goals

At the October 2009 Naval Energy Forum, SECNAV set an energy goal that by 2020, half of the Navy's total energy consumption, ashore and afloat, will come from alternative sources (Ref. 1). In addition to SECNAV's 50 percent alternative energy goal, Office of the OPNAV's TFE has set two goals for Navy Expeditionary Units for 2020 (Ref. 2):

- Reduce fuel consumption by 15 percent when compared to Fiscal Year (FY) 2008 baseline – by changing how equipment is used (i.e. effective management of resources).

- Increase fuel efficiency of end items by 15 percent when compared to FY 2008 baseline.

TFE consumption and efficiency goals aid in meeting the SECNAV's 50 percent alternative energy goals by reducing the total fuel needed in 2020. When NECC meets the two TFE goals above, the total fuel needed decreases. Decreasing total fuel consumption will decrease the amount of alternative sources required to meet the SECNAV 50 percent mandate.

Achieving these goals will require both a strategy and significant investment in:

- RDT&E.

- An infrastructure that can deliver alternative fuel to expeditionary locations.

- Modifying/procuring equipment to use alternative fuels.

Reducing overall fuel usage will aid in:

- Reducing the number of fuel convoys required to support Forward Operating Bases (FOBs), which results in fewer military casualties and cargo losses on convoy attacks from improvised explosive devices (IEDs).

- Meeting energy goals and requirements mandated by federal law (Ref. 3), the DoD (Ref. 4 and 5), and the Department of the Navy (DoN).

- Reducing reliance on foreign fossil fuel suppliers.

- Reducing greenhouse gas and other harmful exhaust emissions resulting from the use of fossil fuels during deployments.

Need for a Navy Expeditionary Combat Command Energy Strategy

The NECE Strategic Plan 2010" Initiative 3.4 (Tactical Energy Security), (Ref 2) tasks the NECC to:

- Establish FY 2008 baseline fuel consumption and cost data across the force.

- Develop a NECC 15-year strategy to meet the Navy's goals to reduce energy consumption, improve energy efficiency, and increase alternative energy use in the expeditionary forces of the NECC.

NECC and NECE Overview

NECC is the single type command for the Navy's expeditionary forces and the central management for the current and future readiness, resources, manning, training and equipping of those forces.

NECE develops and continually improves supporting policies and processes essential to sustaining units ready for tasking in support of the NECC mission. Specifically NECE:

- Implements measurable, capabilities-based readiness levels with associated cost elements.
- Continues to mature behaviors throughout the enterprise to achieve cost-wise outcomes that optimize readiness.
- Integrates overlapping processes across NECE.
- Interfaces with other Enterprises and providers to establish synergies and reduce redundancy.

NECE consists of the NECC staff, all subordinate commands, OPNAV, and SYSCOMs that influence and support the warfighting capability of the NECC Forces. Naval Facilities Engineering Command (NAVFAC) acts as the lead SYSCOM for NECC. The two other primary SYSCOMs in NECE are Naval Sea Systems Command (NAVSEA) and Space & Naval Warfare Systems Command (SPAWAR).

BACKGROUND

Reviewing government and commercial alternative energy and fuel efficiency initiatives identified several areas that have potential application to NECC. They include candidate end items that range from being immediately available Commercial Off the Shelf (COTS) to requiring longer term NECC specific development programs. Also, as many of the technologies are rapidly emerging or evolving, simply refreshing the energy consumers in the TOA will result in improvements over time. Based on the SECNAV and TFE goals, the three strategy focuses are:

(1) Use of alternative energy sources in expeditionary operations.

(2) Pursuit of equipment efficiency.

(3) Reduction of fuel consumption through changing equipment usage in expeditionary operations.

To meet these goals with solely materiel solutions would be cost prohibitive. Although end item use changes can result in significant fuel consumption reductions, it is impossible to meet the SECNAV and TFE energy consumptions goals only by changing how end items are used. Therefore, NECC must concentrate on joint solutions because

NECC components cannot independently develop numerous independent technologies and then test and evaluate the developed end items before deployment.

This strategy will be reviewed and updated periodically and as required. Appendix A lists the governance structure for updating this strategy.

APPROACH

Refine FY 2008 Baseline

Deployed NECC units do not have a current baseline or an established means to measure Outside the Continental United States (OCONUS) fuel usage; therefore, options to meet the requirements set forth by the SECNAV are being developed. The wide range of fuel consuming equipment, their operating environments, and the commercial or joint nature of their acquisition makes measuring Navy expeditionary fuel use and subsequent investment decisions difficult.

Currently, NAVFAC Engineering Service Center (ESC) is refining the Fuel Consumption Estimation Tool (FCET) developed by ESC to estimate the FY 2008 baseline. Appendix B describes both the FCET and lists preliminary annual fuel consumption rates for end items in all NECC deployable TOAs. In addition, NAVFAC ESC has acquired Continental United States (CONUS) fuel usage data for NECC units from Defense Energy Supply Center (DESC).

As a first step to collecting OCONUS fuel use data, a NECC fuel data architecture ("as is" and "to be") and model will be developed. The data architecture will enable logisticians to understand the gaps between current methods to capture fuel use related data and the future data capture process. Two primary options exist for capturing fuel data: fuel data can be captured manually or by sensors automatically. To accurately capture fuel data, the process may require changes to existing information systems, such as the NECC Equipment Dispatch System (NEDS) and installation of sensors on selected equipment. The fuel use model will allow logisticians to estimate current and project future fuel usage below Echelon IV by class of vehicle or equipment type. An estimated baseline will be quickly established based on real data. For TOAs, estimating the percent of fuel consumption CONUS vs OCONUS for each end item will help determine opportunities to save fuel. Appendix C describes possible data collection processes in more detail.

Consider Best Cost to Results (Cost Effectiveness)

NAVFAC ESC has identified the following areas (in no particular order) that have applicability to the TOA and will be considered for meeting NECC energy goals to provide the most cost effective strategy:

1. Concentrate on top 5 direct fuel consumers

Table 1 lists the top five direct fuel consumers in the deployed TOAs based on initial estimates. These initial estimates did not include either Seabee Tent Camps or the TOAs for the Navy Expeditionary Logistic Support Group (NAVELSG). The Seabee Tent Camps were excluded because they are used by both NECC and non-NECC Navy components. The NAVELSG TOA was excluded because this TOA was not yet deployed in FY 2008. Table 1 results from calculations described in Appendix B, Table B-9.

Table 1. Top Five Fuel Consumer Groups in TOA.

Description of Group	% of Total Yearly Fuel Consumption
Medium Tactical Vehicle Replacement (MTVR) group	36%
Construction equipment, material handling, equipment, cranes and motor transport group excludes MTVRs, generators and ECUs	31%
Watercraft group (all boats excluding four landing craft, and two amphibious resupply lighters)	17%
Generator group	10%
ECU group	5%
Total percent of top five fuel consumer groups	99%

Table 1 excludes 1% of the fuel consumers in the TOAs. Examples of fuel consumers excluded are heaters and kitchen equipment.

A major part of NECC's strategy will be to concentrate efforts on increasing efficiency, reducing fuel use and using alternative fuels in these "Top 5 Fuel Consumers." See the "FOCUS AREAS" section of this strategy for more details.

2. Capitalize on other DOD and commercial initiatives

The use of COTS technologies and new technologies developed by other services will both reduce need for extensive RDT&E as well as reduce time from technology identification to fielding. NECC's supporting SYSCOMs may need RDT&E funding to:

(1) Modify COTS and Government Off the Shelf (GOTS) available end items suitable for NECC use.

(2) Validate COTS and GOTS available end items are suitable for use.

(3) Develop new end items that are not being developed by any planned RDT&E.

During the NECC Science and Technology Objective (STO) updates process in 2011, NECC plans to develop a list of energy capabilities for consideration in operational Military Utility Assessment (MUA). STOs are compared with the United States Marine Corps (USMC) and other services to preclude duplication of effort. Several military exercises will serve as MUA and Extended User Evaluation (EUE) environments for these end items, such as Experimental Forward Operating Base (ExFOB), Sea Trail, and other DoD exercises that are dedicated to testing new technology.

3. Consider joint initiatives and commonality of parts and equipment

In the interest of joint operations and capabilities, NECC desires that developments and acquisition are conducted by SYSCOMs with a view towards interoperability and commonality in logistics. Commonality of parts and equipment reduces the logistics tail for spare parts, reduces training time, and decreases acquisition costs. Table 2 lists Top-Level DoD fossil fuel use reduction initiatives that relate to NECC's deployed units.

Table 2. Top Level DOD Initiatives Related to NECC Deployed Units

Initiative Name	Initiative Purpose	POCs
USMC Experimental Forward Operating Base	Determine logistic needs and methods of today's warfighter	Major Sadlier USMC Expeditionary

(ExFOB)	and evaluate the latest technologies from industry to perform function faster, better, and with greater efficiency.	Energy Office (703) 614-4230
Include USMC Expeditionary Energy Water and Waste (E2W2) Initial Capabilities Document (ICD) effort	USMC E2W2 will be primary requirements document governing USMC procurement decisions in immediate future related expeditionary energy water and waste	Ms. Gayle Von Eckartsberg USMC Expeditionary Energy Office (703) 614-4230

Table 2. Top Level DOD Initiatives Related to NECC Deployed Units (Cont.)

Initiative Name	Initiative Purpose	POCs
US Army Base Camps Integrated Capabilities Development Team (ICDT)	Identify US Army's required capabilities during base and base support operations in contingencies. The goal is to develop a capability that provides the US Army adequate base camps that can enable power projection throughout full spectrum operations.	Mr. Steven Orth Army Maneuver Support Center of Excellence Fort Leonard Wood, Missouri (573) 563-2832
US Army Operational Energy Initial Capabilities Document	To analyze how energy relates to operational performance (especially in light of new Army concepts); identify required capabilities, gaps, and solutions.	Colonel Paul E. Roege (US Army), P.E. Special Assistant to the Director for Energy (757) 788-2859 Army Capabilities Integration Center
United States Air Force (USAF) Base Expeditionary Airfield Resources (BEAR) Modernization	Enables rapid runway emplacement with living facilities for personnel, and security for aircraft at the expeditionary base	Mr. Mel Miles (757) 764-5550 USAF Chief, BEAR Global Management
DoD Project Manager Mobile Electric Power (PM MEP)	PM MEP supplies ruggedized power generators and grid management for DoD	PM MEP Mr. Chris Bolton (703) 704-1995
NET ZERO PLUS Joint Capabilities Technology Demonstration	Evaluate energy savings technologies for expeditionary shelters	Mr. Brant Lagoon Army Civilian US Army Natick Soldier RD &E Center (NSRDEC), Natick MA (508) 233-5075
DOD/Navy/Commercial Efforts on Alternative Fuel	Create a biofuel that can replace JP8 without engine modifications to end items	Mr. David Cook - NAVFAC ESC (805) 982-3477
Various water	50% of the cargo carried in	Mr. William Varnava –

purification initiatives	convoys is water. So, decreasing fuel needed to produce potable water, which results in decreased number of convoys delivering potable water	NAVFAC ESC (805) 982-6640

Efficiently Manage Resources

Efficiently managing resources is defined as any action that can be done to reduce fuel consumption without increasing the energy efficiency within the end item. The paragraphs below in no particular order, list five different examples of effectively managing resources. The numbered examples below are not in any particular order.

1. Simulators to lessen supervised equipment operation

Increase the use of simulators to replace supervised equipment operation time to qualify for a particular "military issued" equipment license. Each license requires numerous hours of supervised equipment operation. For the NECC deployed units, most equipment licenses are for fuel consuming equipment, vehicles, or watercraft.

2. Best utilization of grid resources

Using computerized control of generators or alternative power sources for camp electrical grids minimizes fuel usage. Currently, the NECC does not use computerized control of generators or alternative power sources.

3. Continue TOA reconfiguration

NECE has an ongoing effort to reconfigure TOAs to optimize NECC warfighting capabilities, while balancing costs and government policy factors. Energy costs and related environmental policy factors are currently considered in procurement; however, energy cost factors and environmental factors will increase in significance. Considering future technology can effect when and what type of procurement actions (life extension, new purchase, etc.) will occur. To consider future technology, NECE needs a more robust method of to enable continuous modeling of choices/alternatives of possible replacement strategies. Some methods for consideration are developing a market tracker and technology projection model.

4. Managing logistics operations

Often the USMC resupplies NECC deployed units. USMC forces ashore use Common Logistics Command and Control System (CLC2S) to optimize logistics ashore. Optimizing logistics ashore means more efficient distribution from ship to end user, or supply point to end user. Managing logistics ashore can minimize fuel usage for transporting end items. NECC has software to manage supply, but not to optimize logistics ashore. NECC may consider using software to optimize logistics ashore, thereby reducing deployed energy consumption.

5. *Implementing behavioral, operational and procedural changes*

Implementing behavioral changes will help meet NECC's Energy Goals. Effectively communicating the importance of conserving energy such as shutting down unneeded equipment, and soliciting their suggestions for reducing energy consumption can result in significant reductions. Some means to communicate are:

- Inserting articles in newsletters at the unit and higher echelon levels.
- Holding all-hands meetings at unit and higher echelon levels.
- Consideration of fuel usage in operational planning.
- Implementing awards programs similar to NAVSEA Energy conservation program that gives additional funding to ships that underburn projected fuel consumption.
- Establishing fuel usage rates for NECC components, once the FY 2008 fuel consumption baseline has been established.
- Establishing a method to track and electronically archive fuel consumption at various command component levels and select TOA end items.

FOCUS AREAS (GOALS)

There are three focus areas:

(1) Use alternative energy sources.

(2) Pursuit of equipment efficiency.

(3) Reduction of fuel consumption (excluding energy efficiency increases).

Supporting these focus areas will enable NECC to meet the SECNAV goal of using 50 percent alternative energy sources by 2020, and both TFE goals for 2020 listed below:

- Reduce fuel consumption by 15 percent when compared to FY 2008 baseline –excluding fuel efficiency improvements.
- Increase fuel efficiency of end items by 15 percent when compared to FY 2008 baseline.

Use Alternative Energy Sources

The common types of alternative energy sources include renewable energy (wind and solar), fuel cells, and alternative fuels (biofuels and fuel derived from coal).

Renewable energy

There are many DoD and Department of Energy (DoE) solar power initiatives for use by individual deployed military personnel, and wind and solar power for tent camp power generation. There are several emerging containerized renewable energy generators based on photovoltaic, wind, and power storage battery technologies. For example, the ExFOB initiative demonstrated containerized solar, wind, and battery units in August 2010. NECC may be able to leverage the results from the ExFOB effort.

These containerized solar and wind generators have the potential to reduce fossil fuel consumption by up to 50 percent in base camp electrical power generation, which also contributes to significant cost avoidance in the associated fuel transportation convoy costs.

Fuel cells

Advanced technologies such as fuel cell generators are projected to fill a lower power usage niche, with a maximum power output suitable for a 3 kilowatt (KW) generator.

Alternative fuels

Under the "Charter Joint Department of Defense Alternative Fuels Initiative", DoD components are coordinating several initiatives to develop alternative fuels that can be used without modifying existing equipment. NECC's TOAs include these primary categories of equipment that could use alternative fuels:

- CESE
- Civil engineering end items (CEEI)
- Watercraft
- Unmanned aerial vehicles

Through NAVFAC ESC, NECC has SYSCOM participation in the Vehicles/Equipment Working Group (WG) within the DoD Alternative Fuels Working Group. The primary alternative fuels being investigated are the Algal-Derived JP-8 Program, cellulose-based biofuels, bio-diesel, ethanol, fuel derived from coal, and other biofuels. Many commercially available vehicles and forklifts use propane or natural gas, which count as alternative fuel use, but may be a logistics burden in expeditionary operations. Many modern vehicles can also use conventional diesel mixed with up to 20 percent bio-diesel without engine modification. However, long term storage may be an issue with bio-diesel and some other bio-fuels. In addition, NECE is specifically monitoring and working with various DoD components and private industry on RDT&E to use alternative fuels on both inboard and board boat motors.

Via Deputy Assistant Secretary of Navy, Installation, Environment, and Energy (DASN IE&E), NAVFAC's Energy Office (EO), TFE, and other energy offices, NECC will be able to track the advanced development and potential use of alternative fuels for NECC operations.

Increase Energy Efficiency of End Items

The five initiatives below discuss increasing energy efficiency. Initiatives 1 and 2 involve three of the top five direct fuel consumers: ECUs, MTVRs, and HMMWVs (and its future replacement vehicle). Initiatives 3, 4 and 5 involve end items that result in significant fuel consumption reduction from the generators: (3) soft walled shelters – heating/cooling, (4) water purification equipment, and (5) lighting. The numbered initiatives below are not in any particular order.

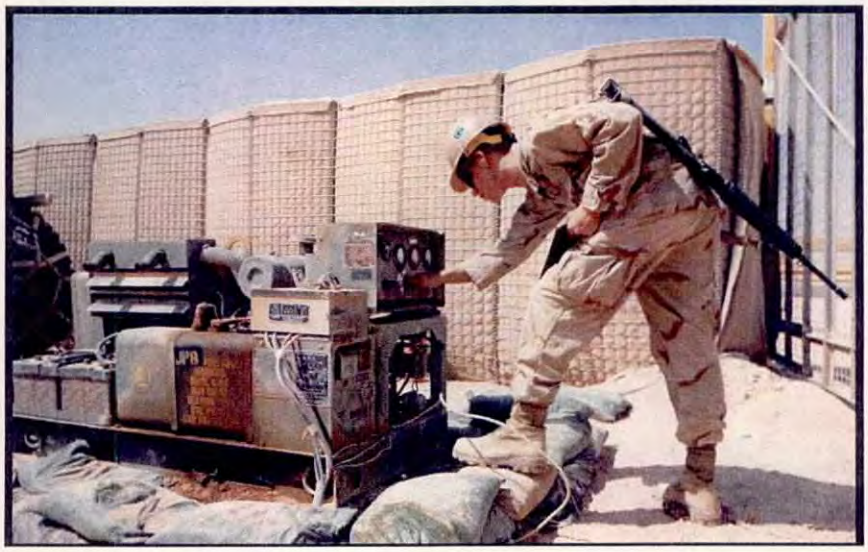
1. More efficient environmental control units (ECUs)

NAVFAC plans to purchase more efficient ECUs being developed by Marine Corps Systems Command (MCSC) in 2011-12. These include both ECUs and ECUs with integrated generators. In the next 20 years, ECU manufacturers will constantly strive to increase ECU efficiency. These efficiency increases may lead to more frequent replacement of existing ECUs.

2. Improved energy efficiencies for CESE

Based on passenger vehicle performance data, electric hybrid (without battery pack) and hybrid electric (with battery pack) technologies can improve fuel economy by 20 to 25 percent. However, equipping any equipment with hybrid technology will raise acquisition costs by about 20 percent. For example, one company recently introduced a

diesel electric hybrid (with no power storage battery) medium size tracked bulldozer, which demonstrated to increase fuel economy of approximately 25 percent and the productivity of approximately 10 percent. By applying hybrid electric (with power storage batteries) technology to all future MTVR and HMMWV (or its replacement) procurement, NECC can reduce its annual fuel consumption by about 10 percent. If the same technology is applied to the top 15 fuel consuming vehicles, construction equipment and forklifts, the fuel consumption reduction will be increased to 12 percent.



Hybrid electric technology may include reclaiming waste energy from braking and exhaust. Regenerative braking is commonly used to capture energy from the vehicle braking. Exhaust heat can be captured either via heat exchangers or using thermoelectric materials. Thermoelectric materials are those that can convert heat into electrical power. However, the recovery of exhaust heat energy will require further Research and Development (R&D) and demonstrations. Hybrid electric technology could be used to power watercraft.

Fuel cell technology is currently under development and it may become available and economical for heavy construction vehicles in the years 2020 to 2025 to further reduce fuel consumption.

Besides electric hybrid, hybrid electric, and fuel cells, lighter and more advanced CESE construction equipment will reduce fuel consumption substantially by using lighter components to reduce vehicle weight and computer related technology to automate operator functions.

3. Insulated shelters

Air conditioning is the single largest consumer of liquid fuel on the battlefield due in large part to cooling/heating un-insulated tents. Insulating temporary structures in an expeditionary environment has proven to be a great success for lowering energy consumption for cooling loads by about 50 percent.

4. Highly efficient potable water generation capability

Both the Army and the USMC have numerous water purification initiatives. NAVFAC is considering purchase of Lightweight Water Purifiers (LWPs) USMC version via modification to USMC LWPs procurement contract and the Tactical Water Purification System (TWPS) Army version via modification to the Army TWPS procurement contract to replace older units. There are more emerging technologies such as high throughput reverse osmosis membrane and energy recovery devices that may be available before 2020 to further reduce energy consumption.

5. LED lighting to replace current incandescent lighting in shelters

LEDs lighting reduces energy consumption by about 75 percent over conventional lighting. US Army Natick Soldier RD&E Center (NSRDEC) is doing research on using LEDs for shelter lighting – including a demonstration in Net Zero Plus Joint Capabilities Technology Demonstration (JCTD). NSRDEC will have GOTS LED lighting for shelters available by 2015.

Changing Equipment Usage to Decrease Fuel Consumption

How NECC uses equipment can decrease fuel usage. The initiatives below include better management of generated power. As stated earlier, generators are one of the top five direct fuel consumers. In addition, reviewing doctrine regarding the Echelon IV, V and VI deployable units could result in additional energy reduction initiatives. Besides doctrine, implementing behavioral, operational and procedural changes and continuing TOA reconfiguration could lead to significant fuel consumption reduction.

The TFE energy goal is 15 percent consumption reduction due to better use of NECC equipment. Employing the Expeditionary Power Management and Distribution (EPMD) technology described in the section entitled "Best utilization of grid resources" will reduce NECC consumption by about 2 percent. This leaves 13 percent consumption reduction needed from doctrinal changes, behavioral, operational and procedural changes, and TOA reconfiguration. Estimating savings from doctrinal changes, behavioral, operational and procedural changes, and TOA reconfiguration is difficult. However, a 13 percent reduction by 2020 is reasonable given the resources and the ingenuity of the

NECC and the support from the NECC SYSCOMs (i.e. NAVFAC, NAVSEA, MCSC, SPAWAR, etc).

Best utilization of grid resources

EPMD, a 2011 Office of Naval Research (ONR) Rapid Technology Transition (RTT) Project, will provide an automated system that monitors and controls voltage and current distribution from one or more generators. It will dynamically manage power supply and demand, resulting in more efficient use of generators. It includes intelligent power management features of load transfer, load prioritization, system health and usage monitoring, and automatic paralleling. Currently, NECC does not use any product to automatically distribute and manage electrical load. Initial estimates show 25 percent reduction in fuel consumption by using EPMD for generators. This equates to about 2 percent reduction in total annual NECC fuel use.

Review doctrine for possible fuel reduction

NECC will review Doctrine at Echelon IV, V and VI deployable components for possible fuel consumption reductions. This includes minimizing fuel consumption during training exercises for readiness certifications. Potential reductions could be accomplished by utilizing shore power instead of generators during certification testing.

SHORT TERM (2011-15) STRATEGIES AND ACTIONS

The short term strategies include:

- Determine the FY 2008 fuel use baseline for NECC.
- Concentrate on top five fuel consumers in TOA for fuel use reduction.
- Partner with USMC and US Army to leverage and develop fuel savings technologies.
- Efficiently manage energy resources to reduce energy consumption.
- Review both doctrines and behavioral, operational and procedural changes to reduce fuel consumption
- Provide energy conservation training to personnel, such as shutting down unneeded equipment, to reduce fuel consumption.
- Focus on energy and fuel efficiency in TOA acquisition.
- Support RDT&E initiatives to support Navy energy goals.
- Continue TOA reconfigurations with planned completion between 2014 and 2020.
- Consider ways to combine energy consumption data with readiness data to develop better Total Ownership Cost (TOC) estimates.

- Monitor and work with various DOD components and private industry on RDT&E to use alternative fuels on both inboard and outboard boat motors

Table 3 lists the FY12 Program Objective Memorandum (POM) initiatives to address two of the top five direct fuel consumers: ECUs and generators.

Table 3. FY12 POM Initiatives Involving ECUs and Generators

	Sponsor	Budget	Funding Status
Improved ECUs	N85	$10.1M	Funded
Integrated Generator & ECU	N85	$4.8M	Funded

In addition, the EPMD effort will receive ONR RTT funding totaling $1.4 M over FY11 and FY12. A POM13 Issue Paper has been submitted requesting RDT&E for NECC's supporting SYSCOMs to address many of the strategies and actions above.

Alternative fuels remain in RDT&E/developmental phases and will not be available in sufficient quantities in the near term.

MID TERM (2016-20) STRATEGIES AND ACTIONS

The mid term (2016-20) energy strategy is to focus on top fuel consumers and use advanced technologies for higher levels of energy efficiency and to integrate advanced technologies in warfare and logistics capabilities for the "next NECC" for FY 2018. All of these may/will require Science and Technology (S&T), technology development and significant funding resources. Test and evaluation will validate suitability of new technology and reduce risks for NECC. NAVFAC will continue to partner with the Marine Corps and the joint forces to evaluate electric hybrid, hybrid electric, and alternative fuel vehicles before replacing the current generation of vehicles and construction equipment during TOA refresh. For example, using hybrid electric technology for the MTVRs and HMMWVs (or its replacement) will reduce NECC's total fuel consumption by about 10 percent per year. Fuel consumption is one factor of DoD mandated TOC estimations. In considering procurement of hybrid electric technology for MTVRs and HMMWVs (or its replacement), other cost factors are initial procurement cost, training cost and maintenance cost. The DOD is developing guidelines to aid in procurement decisions incorporating both tangible costs (initial procurement, maintenance, etc.) and intangible costs (environmental effects, etc). Alternative fuels may be available in the mid term.

In addition, NECC will coordinate with the USMC and US Army on potential alternative fuel use in expeditionary operations during this mid term period. NECC plans to leverage USMC and US Army alternative fuel infrastructure and supplies, when available, for expeditionary operations. Furthermore, NECC and the NECE SYSCOMs will plan for future POM initiatives to enhance our capability to meet the Navy energy goals.

LONG TERM (2021-25) STRATEGIES AND ACTIONS

The long term strategy (2021-25) is to continue to focus on top fuel consumers and encourage advanced technologies for higher levels of energy efficiency and fuel usage reduction while integrating advanced technologies in warfare and logistics capabilities for the "NECC after the next." "NECC after the next" is a vision of NECC in 2024. In coordination with USMC and US Army, NECC will implement advanced technologies such as fuel cell and other advanced technologies, when available, to further reduce fuel consumption. This period will provide validation of initiatives implemented to meet SECNAV's 2020 energy requirement. Alternative energy and fuels will be inserted to the extent feasible operationally and logistically.

ACRONYMS

BEAR	Base Expeditionary Airfield Resources
CEEI	civil engineering end items
CESE	civil engineering support equipment
CLC2S	Common Logistics Command and Control System
CONUS	continental United States
COTS	commercial of the shelf
DASN IE&E	Deputy Assistant Secretary of Navy, Installation, Environment, and Energy
DESC	Defense Energy Supply Center
DOD	Department of Defense
DOE	Department of Energy
DON	Department Of Navy
E2W2	Expeditionary Energy Water and Waste
ECU	environmental control unit
EO	Energy Office
EPMD	Expeditionary Power Management and Distribution
ESC	Engineering Service Center
EUE	Extended User Evaluation
ExFOB	Experimental Forward Operating Base
FCET	fuel consumption estimation tool
FOB	forward operating base
FY	Fiscal Year
GOTS	government off the shelf
HMMWV	high mobility multipurpose wheeled vehicle
ICD	Initial Capabilities Document
ICDT	integrated capabilities development team
IED	improvised explosive device
IE&E	Installation, Environment and Energy
JCTD	joint capabilities technology demonstration
JP-8	Jet Propellant 8 – type of jet fuel
kW	kilowatt
LED	light emitting diode
LWP	Lightweight Water Purifier
MCSC	Marine Corps System Command

ACRONYMS (Cont.)

MTVR	Medium Tactical Vehicle Replacement
MUA	Military Utility Assessment
NAVELSG	Navy Expeditionary Logistic Support Group
NAVFAC	Naval Facilities Engineering Command
NAVSEA	Naval Sea Systems Command
NECC	Navy Expeditionary Combat Command
NECE	Navy Expeditionary Combat Enterprise
NEDS	NECC Equipment Dispatch System
NSRDEC	US Army Natick Soldier RD&E Center
OCONUS	Outside the Continental United States
ONR	Office of Naval Research
OPNAV	Office of the Chief of Naval Operations
PM MEP	Project Manager Mobile Electric Power
POM	Program Objective Memorandum
R&D	Research and Development
RDT&E	Research, Development Test and Engineering
Ref	Reference
RTT	Rapid Technology Transition
S&T	Science and Technology
SECNAV	Secretary of the Navy
SPAWAR	Space and Naval Warfare Systems Command
STO	Science and Technology Objective
SYSCOM	Systems Command
TFE	Task Force Energy
TOA	Table of Allowance
TOC	Total Ownership Cost
TWPS	Tactical Water Purification System
US.	United States
USAF	United States Air Force
USMC	United States Marine Corps
WG	Working Group

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