United States Marine Corps Expeditionary Energy Strategy and Implementation Plan

"Bases-to-Battlefield"

Back Cover: Marine Corps LCpl M.C. Nerl, Combat Correspondent, MCAGCC. USMC Experimental Forward Operating Base (ExFOB); upper and bottom right.

USMC Energy Status Section: Photo: Sgt Brian Lautenslager

TABLE OF CONTENTS


U.S. MARINES

Commandant's Message

Marines, Sailors, Civilian Marines, and Families,

The Marine Corps' unique capability to respond to conflicts and crises worldwide requires an expeditionary mindset. Maintaining the agility to deploy at a moment's notice defines the way we organize our forces, how we train, and what kind of equipment we buy. We are "first to fight" because we are always ready to go. This expeditionary mindset underpins our role as America's force in readiness.

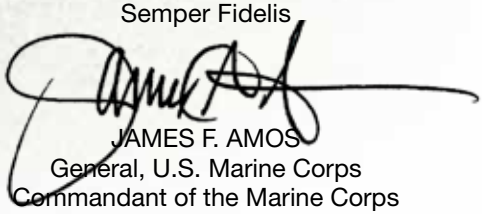
Over the last ten years, our nation has called on us to fight two wars and respond to humanitarian crises around the globe. Leveraging the full spectrum of our capabilities, we have countered insurgencies in Iraq and Afghanistan and brought relief to victims in earthquake-stricken Haiti and flood-ravaged Pakistan. Innovation and adaptation – hallmarks of our expeditionary mindset – continue to give us the upper hand in complex and dynamic operating environments.

As a Corps, we have become more lethal, yet we have also become increasingly dependent on fossil fuel. Our growing demand for liquid logistics comes at a price. By tethering our operations to vulnerable supply lines, it degrades our expeditionary capabilities and ultimately puts Marines at risk. To maintain our lethal edge, we must change the way we use energy.

The current and future operating environment requires an expeditionary mindset geared toward increased efficiency and reduced consumption, which will make our forces lighter and faster. We will aggressively pursue innovative solutions to reduce energy demand in our platforms and systems, increase our self-sufficiency in our sustainment, and reduce our expeditionary foot print on the battlefield. Transforming the way we use energy is essential to rebalance our Corps and prepare it for the future.

We are a nation at war, and our Marines and Sailors in combat are our number one priority. Energy efficiency will increase our combat effectiveness and save lives. The following pages map out our way ahead – for the current conflict and for the challenges of the future. This "Bases to Battlefield" strategy will ensure that we continue to live, train, and fight as an expeditionary force. Through innovation and a willingness to adapt, we will remain the ready and relevant force that America relies on in times of crisis.

Semper Fidelis



JAMES F. AMOS
General, U.S. Marine Corps
Commandant of the Marine Corps

Purpose

Purpose

On 13 August 2009, the Commandant of the Marine Corps (CMC) declared energy a top priority for the USMC.[1] On 1 October 2009, the CMC created the USMC Expeditionary Energy Office (E^2O) with the mission to "analyze, develop, and direct the Marine Corps' energy strategy in order to optimize expeditionary capabilities across all warfighting functions." Further, E^2O's role is to "advise the Marine Requirements Oversight Council (MROC) on all energy and resource related requirements, acquisitions, and programmatic decisions."[2] E^2O serves as the Functional Advocate for Operational Energy.[3]

The USMC Expeditionary Energy Strategy is the Marine Corps framework that communicates the CMC's vision, mission, goals, and objectives for expeditionary and installations energy. The USMC Expeditionary Energy Strategy Implementation Planning Guidance included in Annex A sets the course to move the strategy from paper to reality. It identifies specific tasks and responsibilities, as well as timeframes for achievement. Taken together, these documents respond to CMC guidance to "develop a plan to decrease the Marine Corps' dependence on fossil fuels in a deployed environment."[4] They also align the Marine Corps with guidance and mandates for operational and installation energy established by our civilian and military leadership.[5] And finally, they provide the foundational guidance for energy investments and management across the Marine Corps from Bases to Battlefield.

Lance Cpl. Dakota Hicks, a native of Laharpe, Ill., and a machine gunner with 2nd Platoon, India Company, 3rd Battalion, 5th Marine Regiment, connects a radio battery to a Solar Portable Alternative Communication Energy System at Patrol Base Gumbatty in Sangin District, Dec. 31, 2010. SPACES is a flexible solar panel, that can be carried by a Marine and is used for recharging radio batteries. With more room in their packs from fewer batteries, the coalition forces can pack more essentials, like ammunition. SPACES is one of four renewable energy devices that comprise the Experimental Forward Operating Base project. Photo: Gunnery Sgt. William Price

USMC Energy Status

USMC Energy Status

Over 235 years, the Marine Corps has borrowed more than a few pages from Sparta's history to inculcate a warrior ethos in our ranks. We view ourselves as the modern-day Spartans – fast, lethal and austere. While we have proven lethal fighting in rugged environments for nearly a decade now, our energy consumption is far from Spartan. Because of our thirst for liquid fuel, we're not as light and agile as we once were, putting both our Marines and our expeditionary capabilities at risk.
In building our nation's most effective and lethal force, we have assumed that energy will always be there—like oxygen. Our mindset will change.

General James F. Amos

The Marine Corps today consumes in excess of 200,000 gallons of fuel per day in Afghanistan.[6] Each of the more than 100 forward operating bases in Afghanistan requires a daily minimum of 300 gallons of diesel fuel.[7]

Our nation's adversaries recognize this growing vulnerability and target fuel and water convoys, knowing full well the second, third and fourth order effects of disrupting our supply chain.

The price of our addiction to liquid fuel in war can be measured in many ways: number of convoys at risk on the road, IED incidents, patrols diverted for force protection, operations delayed waiting for resupply, weight and cube exceeding air and sealift, and dollars per barrel.

Ultimately, it must be measured in lives risked—and lost. During a three-month period early in 2010, six Marines were wounded hauling fuel and water to bases in Afghanistan during just 299 convoys. That is one Marine wounded for every 50 convoys. [8] [9] [10]

Over the last 10 years through the fight in Iraq and Afghanistan, our energy consumption has grown exponentially, driven by enhancements to command, control, communications, computers, and intelligence (C4I) technologies; hardened vehicles; and weapons systems we have fielded. In executing this prolonged campaign, our sustainment has also increased.

In 2001, a Marine infantry battalion had 64 humvee variants. Today, it has 173 MRAPs and M-ATVs. Moreover, vehicles are 3,000 to 5,000 pounds heavier apiece, decreasing fuel efficiency 30 percent across the tactical fleet.[11]

Our demand for electricity and battery power is also growing rapidly. We have seen a 300 percent increase in the use of computers, and the number of radios has increased threefold.[12] About 60 percent of the power requirement in Afghanistan is to run environmental control units to keep command, control, and communications equipment operating.[13]

All of these warfighting assets have made our combat forces more lethal but with a grave unintended consequence – our logistics trains are at greater risk.[14]

Fuel and water must be trucked into Afghanistan over long distances through difficult terrain and challenging weather conditions. Convoys, vulnerable to asymmetric and conventional attack and disruption, are exposed targets that increase mission risk and divert combat power for protection that

In the late 1980s, the Marine Corps' total inventory of battlefield power generation was 65MW. Today we have 303MW, a nearly five-fold increase.

In Operation Enduring Freedom in Afghanistan, we have a deployed 64MW of capacity—which is enough to power a small city the size of Camp Pendleton two times over, or provide 3.4 kW of continuous power per Marine.

* * *

Marine infantry companies use more fuel than infantry battalions did 10 years ago. Changes in the MAGTF include—

- 250% increase in radios
- 300% increase in IT/computers
- 200% increase in # of vehicles
- 75+% increase in vehicle weight
- 30% decrease in MPG across the tactical vehicle fleet

* * *

The upward trend in energy required to fight our wars is not new. Since the Vietnam conflict, there has been a 175% increase in gallons of fuel consumed per U.S. Soldier, Sailor, and Marine per day, for an average annual increase of about 2.6 percent in the last 40 years. That ratio could increase by 15.6 percent by 2017, for a compounded annual growth rate of 1.5 percent.

could otherwise be employed in operations against the enemy. And, in paying for fuel transit, we run the risk of indirectly funding our adversaries.[15] [16]

Furthermore, supplying the Marine Air-Ground Task Force's (MAGTF) growing energy requirement strains sustainment planning and execution at all levels of war—tactical, operational, and strategic.[17] Our fuel requirement limits our range and freedom of maneuver from the sea and on land. It constrains our tactical options for executing missions in complex battlespaces, across long distances, and against hybrid threats. Tethered to fuel, we have lost speed.

Marines with Alpha Company, Combat Logistics Battalion 6, 1st Marine Logistics Group (Forward), prepare to gravity feed fuel into stationary tankers at Combat Outpost Nolay July 13, 2010. A combat logistics patrol numbering more than three dozen vehicles arrived with fuel and communications and computer equipment after nearly two days of crawling through improvised explosive device-laden desert. The gear will enable American forces in Helmand's volatile Sangin district to establish their own combat operations center and increase the general livability at the growing base.
Photo: Sgt Justin J. Shemanski

In the future, the burden of fuel is likely to increase because our investments in modernizing our forces are fuel hungry. Fifty-eight Marine Corps' acquisition programs require direct generator support, with a critical or dedicated requirement for power. Fuel-burning engines power 54 of our programs and major end items. Among all programs, more than 600 end items require battery power.[18]

The Marine Corps recognizes that energy consumption is a growing vulnerability and has vowed not to cede the energy high ground to our enemies. We also recognize that the security environment of the future will again require Marines to operate across the Range of Military Operations (ROMO) in austere environments where excess and luxury is not practical.[19]

While we are focused on the Marine Corps mission, we also recognize that the global energy environment is changing—in ways that have strategic impact on our nation and, ultimately, on our way of war.

World energy consumption is expected to grow approximately 40 percent over the next 25 years, with 77 percent of the projected increase in demand expected to be for fossil fuels.[20] The United States today depends on imported petroleum—about 57 percent of its needs[21]—as do major powers, such as China, Germany, Japan, and South Korea.[22] Future supply is not unlimited, or assured. Saudi Arabia and the Organization of Petroleum Exporting Countries (OPEC) control more than two-thirds of global oil production.[23] Government-controlled national oil companies (NOC)—many in countries that are unstable or prone to conflict—command more than three-fourths of the world's known oil reserves.[24]

We are acutely aware that volatile oil prices have had a dramatic impact on our defense budgets, causing large sums of money to be programmed or reprogrammed to meet basic energy operating costs, shifting funds away from other priorities. An increase of $10 per barrel for the Department of Defense (DoD), at today's consumption levels, is an increase equivalent to the entire Marine Corps' procurement budget.

And finally, on the homefront, a secure source of energy is critical to our ability to maintain readiness. Our installations rely primarily on the commercial electrical grid and gas infrastructure to power the training and mission support operations that prepare Marines for combat. This dependence leaves us vulnerable to accidental or intentional energy and power disruptions and places our mission-critical operations at risk.[25]

"Unleash us from the tether of fuel."

Lieutenant General James Mattis
Future Fuels, Naval Research Advisory Committee Report, April 2006

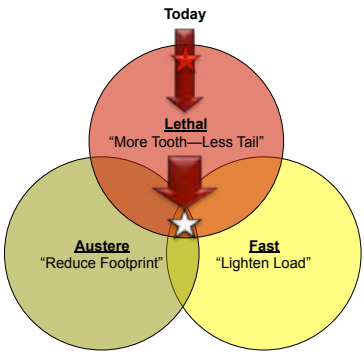
Guidance & Intent

Guidance

Bringing the Marine Corps Back Into Balance

Energy is an essential combat enabler and a critical vulnerability. The way we have brought the fight to the enemy has yielded success on the battlefield. It has also created unprecedented demands for fuel and water that tether Marines to long logistic tails and limit our ability to maneuver as an expeditionary force. At a strategic level, our dependence on fossil fuels exposes us to a supply chain with constantly fluctuating prices, and petroleum supply routes and sources located in volatile regions of the world.

Over the last ten years, we have become more lethal, but we have become heavy. We have lost speed. To reset the balance, we must return to our Spartan roots—fast, lethal, and austere.



Intent

To change the way the Marine Corps employs energy and resources to increase combat effectiveness and reduce our need for logistics support ashore.

We must align our expeditionary energy posture with the future force called for in the *Marine Corps Vision and Strategy 2025*. To this end, on the battlefield, we will—

- Achieve resource self-sufficiency in our battlefield sustainment

- Reduce energy demand in our platforms and systems
- Reduce our overall footprint in current and future expeditionary operations.[26]

At our bases and stations, we will—

- Ensure a secure, reliable, and affordable energy and water supply to support operating forces and their families
- Reduce lifecycle operating costs of Marine Corps installations and manage future commodity price volatility
- Support our nation's efforts to reduce greenhouse gas emissions and environmental impacts, reduce dependence on foreign oil, and promote conservation of water supplies.

"As requirements to fight in more austere conditions and in a dispersed manner become more frequent, a central enhancement required across elements is reducing energy consumption. Less dependency on energy allows the MAGTF to travel lighter—with less fuel and batteries. It allows us to move faster, through the reduction in bulk supplies and the reduction in size and amount of equipment. New technologies and techniques that reduce our cube and weight as well as our dependency on energy allow the MAGTF the ability to conduct operations in the most austere of environments—where excess and luxury is not practical."

Marine Corps Operating Concepts 2010

Vision, Mission, and Scope

Vision, Mission, and Scope

Vision

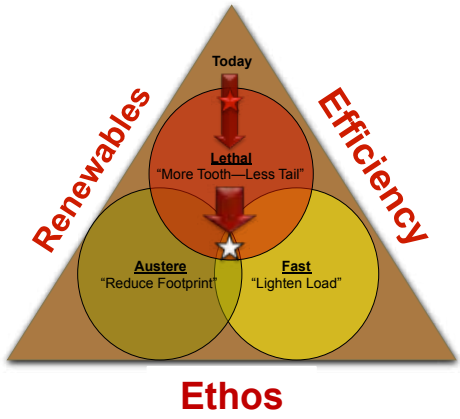
To be the premier self-sufficient expeditionary force, instilled with a warrior ethos that equates the efficient use of vital resources with increased combat effectiveness.

Mission

By 2025 we will deploy Marine Expeditionary Forces that can maneuver from the sea and sustain its C4I and life support systems in place; the only liquid fuel needed will be for mobility systems, which will be more energy efficient than systems are today.

Achieving success will require no less than institutional change. First, we must procure and use more efficient equipment and upgrade our legacy equipment. Second, we must increase our use of renewable energy though innovation and adaptation. Finally, and most critically, we must change the way we think about energy – our warrior ethos must equate the efficient use of energy and water resources with increased combat effectiveness.[27]

The objective is to allow Marines to travel lighter—with less—and move faster by reducing size and amount of equipment and dependence on bulk supplies.[28]



Scope

The USMC Expeditionary Energy Strategy spans the full spectrum of Marine operations, from Bases to Battlefield, because "...being truly expeditionary is based upon an institutional and individual mindset, not simply the ability to deploy overseas."[29]

This strategy is holistic. Although it emphasizes our expeditionary operations, it spans our bases and stations and the intersection between these two mission sets. As the "fifth element" of the MAGTF,[30] our bases, stations, and Garrison Mobile Equipment (GME)[31] provide essential support to sustain and enhance Marine Corps' combat readiness. And because our ethos is rooted in how Marines train and live, as well as in how they fight, what we do on our bases influences the expeditionary mindset.

The Expeditionary Energy Strategy problem set encompasses operational energy, which is "the energy required for training, moving, and sustaining military forces and weapons platforms for military operations…(including) energy used by tactical power systems and generators and weapons platforms."[32]

Lance Cpl. Andrew C. Grencer, a water purification technician with Utilities Platoon, Service Company, 8th Engineer Support Battalion, 1st Marine Logistics Group (Forward), turns on a water pump at Forward Operating Base Nolay in Helmand province, Afghanistan, Dec. 5, 2010. Water purification technicians with 8th ESB provide laundry and shower services for Marines with 3rd Battalion, 5th Marine Regiment, 1st Marine Division (Forward), who operate from the FOB. Photo: Lance Cpl. Kenneth C. Jasik

Because of the inherent link between water and energy, the Expeditionary Energy Strategy also includes the efficient use of water resources. A vital resource in fielding an expeditionary combat force, significant energy and infrastructure are required to produce, treat, and transport potable water and to collect, treat, and dispose of waste water. Demand for water creates a significant battlefield logistics tail in its own right, ultimately increasing fuel demand.

The operational context for the solution set is the expeditionary edge. We will focus on Marine Corps early entry operations from sea-based platforms, employing light forces executing operations in support of maneuver across the ROMO. We will assume contested lines of communication (LOC). We will also focus on the transition

from Marine operations to supported sustained Joint operations. We will consider engagement with the local population and opportunities to transition energy and water supply capabilities to local use when our mission is complete.

The problem set for the "bases" element of our strategy includes energy to power our installations and bases, as well as GME fuels.

> *"To a Marine, the term 'Expeditionary' is more than a slogan; it is our state of mind. It drives the way we organize our forces, how we train,and what kind of equipment we buy."*
>
> 35th Commandant of the Marine Corps,
> *Commandant's Planning Guidance*

USMC Expeditionary Energy Goals

USMC Expeditionary Energy Goals

The Marine Corps Expeditionary Energy goals span Bases to Battlefield and provide the operational framework for increasing our combat effectiveness through ethos, energy efficiency, and use of renewable energy.

Our overarching objective is to increase our operational energy efficiency on the battlefield by 50 percent and, in doing so, reduce fuel consumed per Marine per day by 50 percent. The result will be decreased demand for logistics support, particularly for liquid fuels.

Our approach to installation energy will achieve legislative, executive, and Secretary of the Navy mandates for reduced energy and water consumption and increased use of alternative energy. Through the combination of on-installation alternative energy production and energy demand reduction, 50 percent of our bases and stations will be net-zero energy consumers by 2020.[34]

We will achieve the following goals:

Bases and Battlefield

1. ***Embed Expeditionary Energy Into the USMC Ethos.*** Forge an ethos throughout the Marine Corps equating energy and resource efficiency with combat effectiveness. We will incorporate energy considerations into our planning and operations and will train our Marines to employ energy and water more efficiently.

2. ***Lead and Manage Expeditionary Energy Performance.*** By 2015 Marine Corps equipment and systems will be monitored to enable commanders and program managers to track and manage energy and water demand levels and overall usage.

"Reducing the military's dependence on fuel for power generation could reduce the number of road-bound convoys....Without this solution [renewable energy systems], personnel loss rates are likely to continue at their current rate. Continued casualty accumulation exhibits potential to jeopardize mission success..." [33]

Lieutenant General Richard Zilmer

E^2 GOALS	Efficiency Gains		
	2015	2020	2025
Embed E^2 Into USMC Ethos	25%	40%	50%
Lead and Manage E^2			
Increase Energy Efficiency of Weapons Systems, Platforms, Vehicles, and Equipment			
Meet Operational Demand With Renewable Energy			
Reduce Energy Intensity (EISA 2007)	From 2003 to 2015, reduce energy intensity at installations by 30%		
Reduce Water Consumption Intensity (EO 13514)	Through 2020, reduce water consumption intensity by 2% annually		
Increase Renewable Facility Energy (NDAA 2010, SECNAV)	By 2020, increase amount of alternative energy consumed at installations to 50%		
Decrease Petroleum Consumption (SECNAV)	By 2015 decrease non-tactical petroleum use by 50%		

Battlefield

1. ***Increase Energy Efficiency of Weapons Systems, Platforms, Vehicles, and Equipment.*** We will upgrade legacy equipment and develop and acquire more energy-efficient capabilities in the future. This effort will include, at a minimum, weapons systems and platforms; air, ground and naval vehicles; C4I equipment; shelter, water, waste, sustainment and life support systems and equipment.

2. ***Meet Operational Demand With Renewable Energy.*** We will seek innovative renewable energy and energy storage capabilities that can be deployed in expeditionary environments.

Bases and Installations

1. ***Reduce Energy Intensity.***[35] From 2003 to 2015, we will reduce our energy intensity at installations by 30 percent. To date, we have achieved a 9.5-percent reduction. We will focus broadly across the range of facilities, utility systems, and equipment pools. We will meet our goal through a combined effort of eliminating waste through upgrades and retrofits, performing energy audits and recommissioning energy consuming systems, demolishing inefficient infrastructure, and constructing new installations that incorporate energy saving features. We will employ metering, energy load planning, and micro-grid applications to optimize energy sources and reduce costs.

2. ***Reduce Water Consumption.*** Through 2020, we will reduce our water consumption by two percent annually using water awareness campaigns and water saving devices and replacing inefficient utility systems.

3. ***Increase Alternative Energy.*** By 2020, we will increase the amount of alternative energy consumed at installations to 50 percent of total energy consumption. Through the combination of aggressive demand reduction and on-installation renewable energy production, we will transform half of our installations into net-zero energy consumers.[36]

4. ***Reduce Non-Tactical Petroleum Use.***[37] By 2015, we will reduce the amount of petroleum used in the commercial vehicle fleet by 50 percent through the phased adoption of hybrid, electric, alternative, and flex-fuel vehicles. Included in this effort is the infrastructure required to refuel and maintain the vehicle fleet. This goal also applies to installations that use petroleum for heating and electrical power production.

Legislative Mandates, Executive Orders, and DoD Directives

The National Defense Authorization Act of 2009 and DoD guidance place increasing emphasis on energy security and include directives for operational energy management, planning, requirements development, and acquisition.[38] The CMC's goals and priorities align the Marine Corps with this guidance. Our strategy anticipates future guidance and positions the Marine Corps to lead operational energy innovation and management and renewable energy production for expeditionary forces within the DoD.

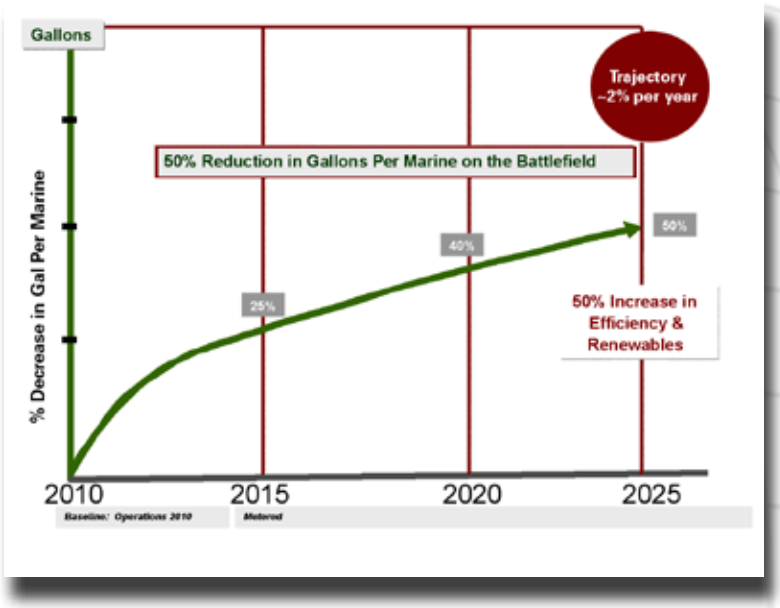
Mandates that establish goals for overall facility energy intensity, greenhouse gas emission reductions, and renewable energy drive Marine Corps installations and GME energy and water programs. Recent legislation and Executive Orders have expanded mandatory energy reduction goals, broadening the focus from demand-side efficiencies to supply-side alternative and renewable energy development.[39] The CMC's energy goals set the Marine Corps on a course to achieve these mandates and lead DoD and the nation in adopting alternative energy sources and advanced energy-efficient technologies.

SECNAV's Energy Goals

The SECNAV's energy goals address current mandates and establish significantly higher targets for the Navy and the Marine Corps.[40] The USMC Expeditionary Energy Strategy aligns with the SECNAV's goals and supports its priorities for energy security and energy independence. We will achieve SECNAV goals to meet 50 percent of our consumption needs with alternative fuels afloat by working closely with our naval partners to ensure our energy consuming equipment is certified for future alternative fuels.

Expeditionary Concept of Operations—A Phased Approach

Reshaping our energy posture will take time. Therefore, we must begin now to implement change simultaneously and across multiple Lines of Operation. Leadership and initiatives focused on changing behavior will drive the strategy and yield immediate increases in energy and water use efficiency on the battlefield. In the near term, we will provide commanders the information they need to drive efficiencies that translate into combat effectiveness.



We will immediately engage the process of upgrading our weapons systems and equipment. We will drive energy efficiency requirements into our ongoing procurement activities and initiate programs to upgrade our current systems. We will prominently include energy concerns in our priorities for Science and Technology (S&T) and Research and Development (R&D), and we will actively pursue emergent technologies to meet our needs in the mid and long term. Looking toward the future, the Marine Corps will deliver savings over the next 15 years by shaping energy performance requirements, planning for technology development and acquisition, and adjusting programming investments. This phased approach to achieving our goals is shown above.

Installation Concept of Operations Supporting the Expeditionary Ethos

Energy and water resources are essential to providing the operational support necessary to sustain and enhance Marine Corps combat readiness. Because the Marine Corps ethos is shaped at home as well as on the battlefield, we must forge a culture of energy and water efficiency that extends to our bases and stations.

Photo: Pfc. Sarah Anderson

Our strategy builds on the "*Marine Corps Ten by '10 Energy and Water Management Program Campaign Plan*."[41] The path forward integrates planning, assessment, and training with cost-effective operation and maintenance of utility systems, capital investment in retrofits and new equipment, and implementation of energy awareness programs. Our approach emphasizes initiatives to institutionalize accountability for energy and water use at our installations. It also includes initiatives to improve the efficiency of our commercial vehicle fleet.

We will—

- Create an organizational structure that maintains a command committed to the efficient use of energy and water resources
- Use an integrated design approach to optimize energy performance
- Demonstrate leadership in implementing effective technology and management practices
- Procure energy-efficient equipment and products
- Implement training and awareness programs to emphasize user-controlled reductions.

How We Will Measure Success

Expeditionary

If the Marine Corps is to truly become more energy efficient and reduce excess fuel demand, we must measure and manage the amount of energy and fuel we require to achieve our objectives. We must focus on the energy we use to execute the ROMO, as well as to train our Marines. The most useful metric would be gallons of fuel expended for a particular, standardized military objective. However, we currently lack this insight—detailed operational energy data is not routinely collected and reported within the Marine Corps on the battlefield or in training.

The Individual Marine's Energy Footprint

By using the GPMD metric, we are focusing our strategy on our fundamental unit of warfighting: the individual Marine. Each individual Marine will be aware of his or her fuel and water footprint and able to connect his or her actions and equipment performance to Marines at risk providing and protecting fuel resupply logistics on the road.

To provide actionable information, we must develop the ability to track, measure, and report fuel and energy use from smaller force units. Our goal is to have systems in place by 2015 to enable us to do so.[42]

As a starting point, we will establish a rough baseline from aggregate fuel data and operational experience recorded for missions in Afghanistan. Today we know—

- Total gallons of land-based fuel supplied
- Total number of Marines in theater.

We will use this data to determine total Gallons Per Marine Per Day (GPMD). For combat operations in Afghanistan where objectives can be characterized at a high level as a set of recurring needs, this metric will enable us to begin to quantify baselines for GPMD. We will use these baselines to measure progress against energy efficiency improvement goals for the combat force. Using data available as of June 2010, [43] our baseline expeditionary fuel use is approximately eight GPMD.

To leverage this metric, we must compare GPMD where Marines are engaged in fundamentally similar activities under fundamentally similar conditions. We will qualify and compare these metrics against characteristics, such as phase of operations, missions, equipment deployed, and MAGTF size. As we collect and improve our data, we will be able to identify trends, correlate GPMD to other factors, identify best practices, and inform equipment improvements and requirements for new systems. GPMD will also show how behavior modification will reduce fuel demand.

Installations

We will measure our achievement of base and station goals using data reported through the Defense Utility Energy Reporting System (DUERS). Our installations are now installing advanced metering capabilities and are on track to achieve mandated goals for metering electricity by 2012 and other utilities by 2016.

Marines and sailors of India Company, 3rd Battalion, 5th Marine Regiment, and their Afghan national army counterparts, pose in front of solar power system that can keep more than 17 computers and 15 lighting units running throughout the night. Photo: Gunnery Sgt. William Price

"To remain our nation's force in readiness, the Marine Corps must continuously innovate."

Marine Corps Vision and Strategy 2025

Initiatives

Initiatives

We will implement this strategy through a Marine Corps-wide effort encompassing the Warfighting functions and integrated through the pillars of combat development: Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, and Facilities.

Our initiatives are organized into four categories: Lead, Man, Train, and Equip the Marine Corps.

Lead

The way we employ energy is a critical factor in our combat effectiveness. Yet we are unconstrained in our demand for energy on the battlefield, in training, and at home. Materiel and technology solutions will be critical to changing the way we use energy, but they alone will not suffice. The importance of energy efficiency to our mission must be integrated into the mindset of the Marine Corps and institutionalized in the way we execute our mission—from Bases to Battlefield.

Leadership Initiative

The greatest initial gains in achieving a new energy posture will come through leadership.

In winter 2009, one unit commander in Afghanistan recognized that inefficiently run generators at his combat operation post put Marines and the mission at risk. He tasked his ordnance officer "to take as many generators off the grid as we could, and still provide support at full capacity." During the next month, two young corporals "made it happen." They reconfigured the camp's generators and optimized them for electricity production. The post went from running on 20 generators to running on five or six. This and other efforts increased efficiency at the post by 25 percent and decreased the over fuel requirement from 1,200 gal/day to 900 gal/day.

When the connection to operational cost and risk is clear, we see Marines step forward and lead with innovative solutions.

- ***Lead the Expeditionary Energy Ethos in the Marine Corps.*** Instilling expeditionary energy concepts into our warrior ethos will involve the entire Marine Corps senior leadership and leaders throughout the organization.
- ***Give Commanders Tools to Measure and Manage Energy.*** For Marine commanders to increase combat effectiveness through energy efficiency and performance, they must be able to see the energy resource status of their unit at a given moment. This data will enable commanders to validate, manage, and adjust combat-effective, energy-efficient operations. It will also inform our requirements development and acquisition process, providing critical data to focus materiel and non-materiel investments. Along with policy, doctrine, and training, the materiel solutions that give systems and platforms the ability to capture and report essential data are key enablers for this strategy.

- ***Institutionalize the Energy Efficient, Combat Effective Corps.*** We will establish formal requirements for Expeditionary Energy, Water, and Waste that span the full range of DOTMLPF solutions; they will focus program development and drive investments to achieve the goals established in this strategy.
- ***Collaborate With the Joint Community on Expeditionary Energy Requirements.*** The changing nature of the modern battlespace requires us to operate increasingly in Joint, multinational, and interagency contexts. We will establish Joint requirements and a Joint approach to our energy and resource solutions.
- ***Leverage Strategic Partnerships.*** To lead in expeditionary energy capabilities for the warfighter, we must aggressively leverage new ideas, technology innovation, and resources inside and outside of the Government. We will partner with other Services, agencies, academia, industry, and our allies to develop and adopt best practices and technology to transform our organization.
- ***Instill Accountability and Enable Innovation.*** Every Marine, commander, unit, and installation tenant is accountable for leading energy-efficient practices for operations under his or her responsibility. We will plan and monitor our energy performance and water usage in facilities, installations, and GME. We will provide commanders the data they need to reinforce awareness, education, and training to increase efficiency, increase energy security, and lower lifecycle operating costs. Leaders will facilitate an environment that encourages personnel to introduce new ideas and leverage their expertise to implement innovative energy-efficient practices.

Man

- ***Man the Expeditionary Energy Force.*** Enhanced MAGTF Operations have strained our manpower resources and have highlighted the value of utility and water engineering personnel. We will ensure we are manned to advise commanders on expeditionary energy efficiency and support the energy requirements of our forces.

Train

- ***Forge Policy and Doctrine to Institutionalize Change.*** We will integrate expeditionary energy concepts into our operational decision making. Because of the immediate need to reduce the logistic burden of energy and achieve greater energy efficiency on the battlefield, we will inject expeditionary energy concepts into our operational planning and execution. We will embed these concepts into our foundational policies and doctrine to prepare the Marine Corps to meet future mission requirements as an expeditionary force.
- ***Train and Educate Our Marines in Expeditionary Energy.*** We will establish and reinforce the relationship between energy and combat effectiveness through formal training and education. We must analyze the current skill sets and establish future capabilities for the MAGTF to optimize combat-effective, energy-efficient operations. We will use basic and formal schools to train and educate our Marines on the importance and relationship of energy to operational planning and execution.

Equip

We equip our forces today to serve as our nation's premier expeditionary force. Through this strategy, we will establish the Marine Corps as the center of innovation in operational energy efficiency, expeditionary energy systems, and renewable energy technology for the battlefield. We will lead requirements development to inform and guide technology innovation by building a deep understanding of energy challenges and possible solutions. We will reset our processes, injecting expeditionary energy concepts into our requirements and acquisitions decisions.

Sgt. David Doty, a squad leader with 1st Platoon, India Company, 3rd Battalion, 5th Marine Regiment, shows his platoon's solar energy data to Maj. Sean Sadlier, the Expeditionary Energy Liaison Officer, with Regional Command Southwest, at Patrol Base Sparks in Sangin District, Dec. 29, 2010. The Marines and sailors of 'I' Company, 3/5, have been testing the Experimental Forward Operating Base solar energy devices since pre-deployment training in July. "Our generators typically use more than 20 gallons of fuel a day. We are down to 2.5 gallons a day," said Doty, a Fulton, Mo., native. "The system works amazing. By saving fuel for generators, it has cut back on the number of convoys, meaning fewer opportunities for one of our vehicles to hit an IED." Photo: Gunnery Sgt. William Price

We will collaborate with the leading thinkers and innovators in the U.S. Government, academia, and the commercial world. We will be agile and ready to adapt and deploy new capabilities into our operations. We will:

- ***Value Energy in Our Materiel Development and Acquisition:*** We will integrate energy efficiency and energy performance criteria as a requirement and a key evaluation factor for our equipment, vehicles, and weapons systems during source selection, where practicable. We will consider energy performance in the same trade space as cost, schedule, and performance.
- ***Target Materiel Investments in High-Impact Areas.*** We will prioritize investments in materiel upgrades to legacy systems and new equipment to increase energy performance. We will take a systems approach to identify the critical challenges, and we will structure investment strategies to address them.
- ***Focus Technology Innovation on Marine Corps Needs.*** We will drive S&T and R&D—within the Government, academia, and the commercial market—to create capabilities to power Marine expeditionary energy needs.
- ***Lead in Deploying Innovative Energy Solutions.*** We will establish the capability to identify energy-efficient technologies and solutions and renewable energy capabilities. We will rapidly transition technology from R&D to operational qualification. We will embrace new concepts and capabilities and employ them on the battlefield, during training, and in garrison.
- ***Sustain Energy Security and Environmental Stewardship.*** We will take steps to achieve energy security to ensure our ability to prepare Marines for combat operations without mission interruption at our bases and stations. We will continue to reduce emissions and reliance on fossil fuels and will drive adoption of sustainable practices that reduce environmental harm.

Gunnery Sgt. Andrew Suthers, the operations chief for the Infantry Officer Course in Quantico, Va., explains a color-coded light system on the Solar Portable Alternative Communications Energy System at the Combat Center Dec. 13, 2010. The SPACES is designed to tactically charge batteries and run communications equipment in remote areas such as Afghanistan. Photo: Sgt. Heather Golden

“Energy choices can save lives on the battlefield.”

General James T. Conway,
34th Commandant of the Marine Corps

Way Ahead

Way Ahead

The USMC Expeditionary Energy Strategy sets a course to transform the way the Marine Corps employs energy and vital resources. It sets specific targets that will position the Marine Corps to achieve greater combat effectiveness through energy efficiency; increased use of renewable energy; and incorporation of energy considerations into requirements, planning, and acquisition decisions. Most importantly, it will foster an ethos that energy efficiency is a critical force multiplier that will increase our combat effectiveness.

Director E^2O is tasked with leading strategy execution under the guidance of the Assistant Commandant of the Marine Corps (ACMC) and as provided for in the Implementation Guidance in Annex A. In accordance with CMC guidance, implementation of the plan shall begin during FY11 and be fully funded in the POM 13 budget cycle.[44]

Deputy Commandants, Directors, and MSCs will implement this strategy and report progress on its goals to the E^2O each June. The E^2O will track and report progress on strategy execution to the Executive Off-Site (EOS) annually—synchronized with the publication of the Annual Expeditionary Energy Report each October—and to the CMC and ACMC as directed.

Director E^2O, as the Functional Advocate[45] for Operational Energy for the Marine Corps and Associate Member of the MROC,[46] represents expeditionary energy requirements and interests within HQMC processes and within the Expeditionary Force Development System (EFDS). Director E^2O will act as the conduit between the Operating Forces/Supporting Establishment and the various process owners in the EFDS. Director E^2O will work in partnership with the Deputy Commandant for Installations and Logistics (DC/I&L), the Functional Advocate for Energy for Installations.

Key drivers of this strategy—technology, the fiscal environment, and higher level guidance—will likely change over time. The E^2O is responsible for reporting to the CMC, via the MROC, any recommended adjustments and modifications to this strategy. The CMC will approve all adjustments and modifications to this strategy, and all changes will be added as an amendment to this strategy.

All Deputy Commandants, Directors, and MSCs will recommend adjustments to this strategy and will provide their planned investment plan supporting the USMC Expeditionary Energy Strategy Implementation Guidance each October to the E^2O. The E^2O will use this information to make its annual recommendation to the MROC regarding the overall USMC investment in energy. The E^2O will keep a permanent record of all recommendations and will provide timely feedback on all recommendations.

This Strategy and the accompanying Implementation Guidance are in accordance with the *Marine Corps Service Campaign Plan* and will be included as an Appendix in future iterations of that plan. This will ensure alignment and synchronization across the Marine Corps for Expeditionary Energy initiatives.

The Marine Corps' history is built on its ability to adapt to and leverage change and its commitment to serve the United States as the world's most effective and lethal expeditionary force. This strategy is grounded in these fundamental qualities and will ensure our Marine Corps remains at the ready and among our nation's most valued assets.

Endnotes

[1] U.S. Marine Corps (USMC) Energy Summit, 13 August 2009, Washington, DC.

[2] Assistant Commandant, USMC, Memorandum 11/09, *Establishment of the Marine Corps Expeditionary Energy Office*, 19 November 2009.

[3] Deputy Commandant for Combat Development and Integration, USMC, Memorandum 3900 C 06, Functional Advocate for Operational Energy, 10 November 2010.

[4] 35th Commandant of the Marine Corps, *Commandant's Planning Guidance 2010*.

[5] See Annex B.

[6] MEF-A REPOL, *Bulk Petroleum Contingency Report*, June 2010.

[7] Government Accountability Office (GAO) Report to the Subcommittee on Readiness, Committee on Armed Services, House of Representatives, Defense Management, *DoD Needs to Increase Attention on Fuel Demand Management at Forward-Deployed Locations*, February 2009.

[8] Current Operational Analysis Support Team, Operations Analysis Division (OAD), Marine Corps Combat Development Command, *Analysis of Logistics Related Casualties for Marine Forces in Afghanistan*, Quantico VA, September 2010. There were an estimated 299 fuel and/or water convoys, averaging 3 per day, during the 3-month period.

[9] The Army Environmental Policy Institute, in its *Sustain the Mission Project, Final Report, Casualty Factors for Fuel and Water Resupply Convoys*, of September 2009, analyzed data from the U.S. Army from 2003 to 2007. It found that there was 1 killed or wounded for every 24 fuel resupply convoys, and 1 killed or wounded for every 29 water resupply convoys. This data included U.S. military and civilian casualty information for Afghanistan.

[10] United Kingdom (UK) Ministry of Defence. The UK Ministry of Defence tracks casualties associated with fuel logistics. Since 2001,193 non-UK civilian/ national contractors have been killed during fuel support operations. Taken as a percentage of total UK losses, considered together with 301 UK Service deaths, the rate is about 39 percent. June 2010.

[11] DC Installations and Logistics, Life-Cycle Management Branch Requirements Section (LPC-1). January 2011.

[12] Director, Energy Systems, Systems Engineering Interoperability, Architectures and Technology, Marine Corps Systems Command (MCSC), July 2010.

[13] See Annex C.

[14] Report of the Defense Science Board on DoD Energy Strategy, *More Fight, Less Fuel*, February 2008.

* Text box page 8: Top: Program Manager, Expeditionary Power Systems, MCSC, April 2010. Data includes USMC tactical and local commercially-supplied generators. In 2009, the average daily peak demand at Camp Pendleton was 30-35MW. Source: Defense Utility Energy Reporting System as of Q4 2009. Middle: Director, Energy Systems, Systems Engineering Interoperability, Architectures and Technology, Marine Corps Systems

Command, July 2010. Bottom: Deloitte, LLC, *Energy Security, America's Best Defense,* December 2009. This increase "has been driven by several factors: the increasing mechanization of technologies used in wartime, the expeditionary nature of conflict requiring mobility over long distances, and the rugged terrain and the irregular warfare nature of operations."

[15] Filkins, Dexter, "Convoy Guards in Afghanistan Face an Inquiry," *The New York Times*, 6 June 2010.

[16] DeYoung, Karen, "U.S. Indirectly Paying Warlords," *The Washington Post*, 22 June 2010.

[17] *More Fight, Less Fuel*, February 2008.

[18] Program Manager, Expeditionary Power Systems, MCSC, April 2010.

[19] *Marine Corps Vision and Strategy, 2025*. *Marine Corps Operating Concepts 2010*.

[20] International Energy Agency, *World Energy Outlook 2009, Executive Summary.*

[21] U.S. Energy Information Administration, U.S. Department of Energy, *Petroleum Statistics.*

[22] U.S. Energy Information Administration, U.S. Department of Energy, *County Energy Profiles.* Data includes crude oil and refined petroleum products.

[23] *World Energy Outlook 2009, Executive Summary.*

[24] World Bank Group and Center for Energy Economics/Bureau of Economic Geology Jackson School of Geosciences, The University of Texas at Austin, *A Citizen's Guide to National Oil Companies, Part A, Technical Report,* October 2008. PFC Energy cited in Deloitte LLP, *Energy Security, America's Best Defense,* December 2009.

[25] *More Fight—Less Fuel,* February 2008; Office of the Secretary of Defense, *Quadrennial Defense Review Report 2010*, February 2010.

[26] 35th Commandant of the Marine Corps, *Commandant's Planning Guidance 2010*.

[27] Ibid.

[28] Ibid.

[29] *Marine Corps Vision and Strategy 2025*.

[30] Ibid.

[31] GME includes the commercial vehicle fleet.

[32] National Defense Authorization Act of 2009 (NDAA 2009). See Annex B.

[33] Joint Staff Rapid Validation and Resourcing Request, *Renewable Energy System,* 25 July 2006. Submitted by Commanding General, Multi-National Force—West (MNF-W), to address urgent needs of Marine forces in Al-Anbar Province, Iraq.

[34] See Annex B.

[35] Defined in Executive Order 13423 as energy consumption per square foot of building space, including industrial or laboratory facilities.

[36] In keeping with DoD guidance, the USMC "…will also take steps to balance energy production and transmission with the requirement to preserve the test and training ranges and the operating areas that are needed to maintain readiness." See *Quadrennial Defense Review Report 2010*, February 2010. See also *Marine Corps Vision and Strategy 2025*.

[37] This goal does not apply to fossil fuel used in the operation of training systems on ranges and training areas. This fossil fuel use is considered "operational" energy in accordance with the NDAA 2009.

[38] See Annex B.

[39] Ibid.

[40] Ibid.

[41] USMC, *USMC Ten by '10, Facilities Energy and Water Management Program Campaign Plan,* 2009.

[42] This capability will also prepare us to respond to NDAA 2009-mandated reporting requirements for operational energy demand and consumption.

[43] Based on 1st Marine Expeditionary Force (FWD) data, June 2010; 200,000 gallons of fuel/day; 21,000 Marines. Bulk fuel data does not account for intra-theater support provided by the U.S. Army, U.S. Navy, and other sources to the Marine Corps.

[44] 35th Commandant of the Marine Corps, *Commandant's Planning Guidance 2010*.

[45] See Annex D for definition of Advocate and Functional Advocate.

[46] Assistant Commandant, USMC Memorandum 11/09, *Establishment of the Marine Corps Expeditionary Energy Office.*

Annex A
Implementation Planning Guidance

Overview

The USMC Expeditionary Energy Strategy and the Implementation Planning Guidance outline a way ahead to reset the energy posture of the Marine Corps. Taken together with the *Marine Corps Vision and Strategy 2025*, these three documents lay out the "who, what, where, when, and why"—the strategic reasons "why" we must change the way we employ energy; our specific goals, initiatives, essential tasks, milestones; and who is responsible within the organization to carry them out. A fourth effort, the Expeditionary Energy Water and Waste (E2W2) Capabilities-Based Assessment (CBA)/Initial Capabilities Document (ICD), identifies the capabilities, gaps, and solutions—the specific "how" we will achieve our goals.

Herein is CMC's guidance for implementing the USMC Expeditionary Energy Strategy. It is an essential output of a multi-phased process to take the strategy from paper to action to reality. The USMC Expeditionary Energy Office (E2O) leads and oversees this effort, which is organized in four Phases: I Strategy Development, II Mission Analysis, III Assessment and Validation, and a concurrent effort, IV Requirements Development.

Phase I—Strategy Development

The CMC assigned E2O to "analyze, develop, and direct the Marine Corps energy strategy." Beginning in November 2009, E2O conducted extensive outreach to Marine Corps elements; assessed the energy situation in theater; engaged industry, academia, and outside experts; red teamed technology options; and prepared an analysis of the Marine Corps energy posture. In spring 2010, E2O developed the USMC Expeditionary Energy Strategy with the support of E2O's Strategic Direction Planning Group, which included representatives from the Office of the CMC, Strategic Vision Group, National Defense University/ INSS, Center for Emerging Threats and Opportunities (CETO), and all Deputy Commandants (DC) and Headquarters Marine Corps (HQMC) Directors.

Phase II—Mission Analysis

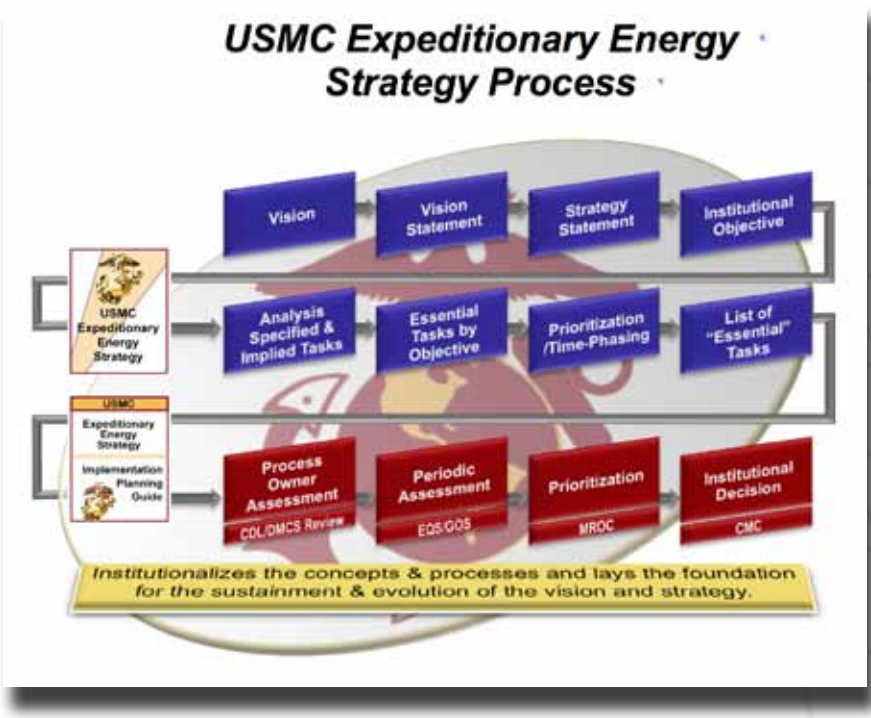
In Phase II of the process, E2O assembled three Working Groups to conduct mission analysis of the mission, goals, and objectives outlined in the strategy. The participants included leaders and experts from across the Marine Corps to the Marine Forces (MARFOR) and HQMC elements. In early May 2010, more than 90 representatives gathered for a two-day working summit to provide feedback on the strategy and

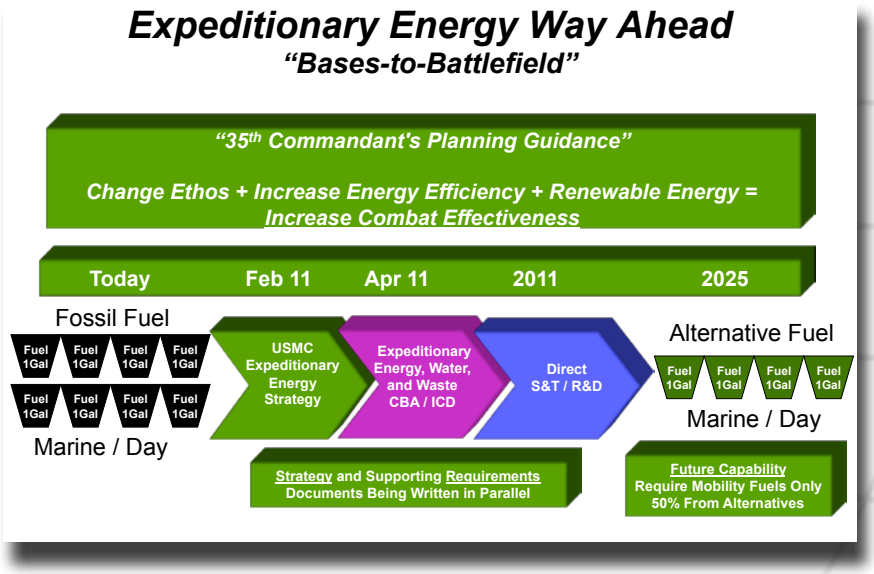
mission and further develop specified and implied tasks, which have become the basis of the Implementation Planning Guidance. This task list has been narrowed to 72 essential tasks, each linked to specific or, in some cases, multiple strategic objectives.

Phase III—Assessment and Validation
In Phase III of the process, task execution will be assessed and approved, performance indicators will be validated or realigned, and the Implementation Planning Guidance will be modified as required. These tasks must be continually validated, verified, and adjusted at regular intervals to coincide with quarterly Executive Off-Site (EOS) conferences where senior leadership will consider the impact of the tasks on the Marine Corps' vision. As members of the Marine Requirements Oversight Council (MROC), senior Marine Corps leadership will therefore directly influence the development of the future Marine Corps energy posture through critical decision points. These decisions will ultimately be incorporated in the Program Objective Memorandum (POM).

Phase IV—Requirements
Concurrent with Phases II and III, E2O, in coordination with DC Combat Development and Integration (CD&I), initiated a CBA/ICD on E2W2. This document, which is scheduled to be issued in early 2011, will identify high-level gaps and requirements and provide a framework for the implementation of tasks cited in the following pages.

These figures provide an overview of the process.





The Implementation Planning Guidance document is organized around the four strategic initiative areas identified in the USMC Expeditionary Energy Strategy: Lead, Man, Train, and Equip, plus a separate category for activities specific to Installations and Garrison Mobile Equipment (GME). Essential tasks are listed accordingly under these areas.

As noted in the Overview section, during Phase III of the implementation process, task execution will be assessed and approved, performance indicators will be validated or realigned, and Implementation Guidance will be modified as required.

For each task, the Office of Primary Responsibility will develop a set of measurable parameters to enable the CMC to track the progress of that task in a quantifiable way. These metrics will be considered as part of the deliverable for each task.

Below is a detailed discussion of the tasks, objectives, and timing for completion.

LEAD

A. Lead the Expeditionary Energy Ethos in the Marine Corps. The way we employ energy is a critical factor in our combat effectiveness. Yet we are unconstrained in our demand for energy on the battlefield. The importance of energy efficiency to our mission must be integrated into the mindset of the Marine Corps and institutionalized in the way we execute our mission. Creating a new ethos regarding energy will require a Marine Corps-wide effort driven by senior leadership and reinforced by leaders throughout the organization—from Bases to Battlefield.

1. NLT February 2011, E2O develop the USMC Expeditionary Energy Strategy and Implementation Planning Guidance establishing priority and direction for Marine Corps expeditionary energy.

2. NLT February 2011, E2O, in coordination with HQMC Division of Public Affairs, prepare a plan to communicate CMC goals on expeditionary energy concepts across the Marine Corps. The plan should include communication strategies, leadership engagement and mobilization, and opportunities to integrate expeditionary energy and efficiency themes across the organization.

3. NLT May 2011, E2O, in coordination with all DCs and Directors, develop a plan to produce an Annual Report on USMC expeditionary energy. The first report will be issued NLT October 2011 and annually thereafter. This report will support National Defense Authorization Act of 2009 (NDAA) requirements for annual reporting of operational energy demand and consumption.

4. NLT May 2011, E2O and the Inspector General (IG) of the Marine Corps assess recommendations and brief a plan to incorporate energy effectiveness into standard inspections to institutionalize the priority goal of energy efficiency. The assessment will address the full range of opportunities, including the IG process and Field Supply and Maintenance Analysis Office (FSMAO) standard inspections. The plan will be implemented NLT January 2012.

B. Give Commanders Tools to Measure and Manage Energy to Increase Combat Effectiveness.

1. NLT June 2011, E2O, in coordination with DC CD&I and all DCs and Directors, develop a comprehensive plan to baseline, track, measure, and manage operational energy consumption and demand. The plan will address the full scope of operational energy within the Marine Corps, which is "the energy required for training, moving, and sustaining military forces and weapons platforms for military operations…(including) energy used by tactical power systems and generators and weapons platforms."[1]

   This effort will scope and define operational energy within the Marine Corps context. It will identify existing and potential data sources to use in establishing initial baselines for measuring current usage and demand.

   The plan will lay out an enterprise-wide capability that will provide commanders and program managers visibility of energy and fuel consumption, as well as energy efficiency performance of weapons systems, platforms, vehicles, and equipment at the unit level up through the Major Subordinate Command (MSC), MARFORs, and HQMC levels. It will provide data and visibility into operational fuel consumption by end item. It will provide visibility into energy requirements, use, and tradeoffs and a means to understand second and third-order impacts of energy requirements on combat resources and effectiveness.

   The plan will address the requirements for the full range of DOTMLPF solutions. It will propose standardized formats for energy consumption tracking and management in the field. It will advise on how to integrate energy efficiency reporting into management and readiness systems and decision making systems.[2] It will leverage ongoing work at USMC installations, the U.S. Navy, and our allies to extend the capability for automated, user-friendly energy management to the expeditionary forces.

   At the enterprise level, this capability will enable the Marine Corps to develop and continually refine baselines and measures of progress toward the goals set forth in this strategy. It will also support NDAA 2009-mandated requirements for annual reporting of operational energy demand and consumption.

The plan will be implemented NLT 2015. The plan will also address policy, to include:

- ❍ **Establishment of energy use profile as a Commander's Critical Information Requirement (CCIR)**
- ❍ **Establishment of expeditionary energy reporting as a data input to the Defense Readiness Reporting System (DRRS).**

2. NLT September 2011, E2O, in coordination with all DCs and Directors, complete an expeditionary energy assessment across the warfighting functions. The assessment will include recommendations for immediate changes to increase energy efficiency and combat effectiveness. It will examine current policies, practices, and procedures; identify gaps; and present recommendations for improvement. It will incorporate input from ongoing assessments, including the MAGTF Requirements List (MRL) process. It will identify options for baselines, initial goals specific to the warfighting function, and appropriate metrics to measure and manage progress toward those goals.

C. Institutionalize the Energy Efficient, Combat Effective Corps. To institutionalize change, we will establish formal requirements that span the full range of DOTMLPF solutions for expeditionary energy, water, and waste. They will focus program development and drive investments.

1. NLT April 2011, DC CD&I, in coordination with E2O, complete and prepare for MROC consideration the E2W2 CBA, issue the E2W2 ICD, and develop a plan to incorporate the CBA results and the ICD into the Marine Corps Expeditionary Force Development System (EFDS) process. The ICD will identify definitive tasks, conditions and standards in order to inform the combat developer and others, relevant to the requirements. It will identify gaps and guide DOTMLPF requirements to achieve efficiencies in energy, water, and waste solutions and systems across the MAGTF.

D. Collaborate with the Joint Community on Expeditionary Energy Requirements. The changing nature of the modern battlespace requires Marines to operate increasingly in Joint, multinational, and interagency capacities. While the Marine Corps strives to improve combat effectiveness through energy efficiency, we recognize that our fellow Service and Coalition partners heavily influence our energy footprint.

1. NLT April 2011, E2O, collaborate with the Joint community on the E2W2 CBA/ICD to identify potential applications in the Joint operating environment.[3]

2. NLT May 2011, E2O, in coordination with DC CD&I, DC I&L and the Joint Staff, develop recommended policies, doctrine, and procedures for achieving energy, waste, and water efficiency requirements in the Joint environment.

E. Leverage Strategic Partnerships. If we are to be the leader in expeditionary energy capabilities for the warfighter, we must aggressively leverage leading ideas, technology innovation, and resources inside and outside of the Government. We will partner with other Services, agencies, academia, industry, and our allies to develop and adopt best practices and technology to transform our organization.

1. NLT April 2011, E2O identify opportunities for partnerships and develop a plan for engagement. This plan will identify priority USMC needs in Research and Development (R&D), visibility into commercial solutions, and access to expertise. It will identify potential partner organizations. Initiate execution of the plan NLT October 2011.

MAN

A. Man the Expeditionary Energy Force. Enhanced MAGTF Operations have strained our manpower resources and have highlighted the value of utility and water engineering personnel. We will ensure we are manned to advise our commanders and support the expeditionary energy requirements of our forces.

1. NLT September 2011, or as determined by the E2W2 CBA, DC CD&I, in coordination with Manpower and Reserve Affairs (M&RA), develop manpower requirements to support expeditionary energy capabilities within the MAGTF. Develop a manpower plan and policies to address identified needs.

TRAIN

A. Forge Policy and Doctrine to Institutionalize Change. We will integrate energy concepts into our operational decision making processes. We must initiate the long-term process of embedding these concepts into our foundational policies and doctrine to prepare the Marine Corps to meet expeditionary mission requirements. Because of the immediate need to reduce our logistic footprint and achieve greater energy efficiency on the battlefield, we must also accelerate our efforts to inject expeditionary energy concepts into our mission operations and planning in the near term.

1. NLT July 2011, or as determined by the E2W2 CBA, E2O, in coordination with DC CD&I, prepare a comprehensive plan to incorporate expeditionary energy priorities and concepts into foundational policies and doctrine. This plan will provide the basis for institutionalizing energy efficiency and energy utilization as an element of combat effectiveness across individual, MAGTF, and combined MAGTF operations. The process will be fully implemented by January 2012.

   In addition, develop a plan to accelerate the development of doctrine and supporting documentation in the near term, utilizing means including—

   - ❍ **Pre-doctrinal guidance and direction, including White Papers, Concept Papers and All-Marines Messages (ALMARS)**
   - ❍ **Doctrine publications currently in review cycle**
   - ❍ **Incorporation into Marine Corps Service Campaign Plans (MCSCP) (battlefield, garrison, installations)**
   - ❍ **Operational Energy Advocate Roadmap incorporated into MCSCP**
   - ❍ **Incorporation into new doctrinal publications**
   - ❍ **Specific doctrine for expeditionary energy.**

B. Train and Educate Our Marines in Expeditionary Energy. The nature of future conflict will require the Marine Corps to conduct operations against hybrid threats in complex and often austere environments, and it will put a premium on our ability to maneuver and fight as an expeditionary force. To address this requirement, we must train and educate our Marines to incorporate energy efficiency into the way we plan and execute missions.

Through our formal training and education processes, we will reset the way our organization thinks about energy by focusing on the individual Marine. We will reinforce the relationship between energy and combat effectiveness. We will analyze the current skill sets and establish future capabilities to optimize the MAGTF for combat-effective, energy-efficient operations.

1. NLT July 2011, E2O, in coordination with the Operational Advisory Groups (OAG), prepare a plan to review, refine, and reinforce existing standard operating procedures (SOP); and tactics, training, and procedures (TTP) to increase efficiency and optimize energy resources. Initiation of this plan will begin NLT September 2011.

2. NLT July 2011, DC CD&I, in coordination with E2O, develop a plan to integrate expeditionary energy concepts and practices across the training and education curriculum to increase proficiency at all levels. Analyze and determine, in concert with the establishment of doctrine and policy, expeditionary energy training and education requirements, and recommend where and how to inject energy efficiency concepts and practices into the training and education continuum. Consider the full spectrum of training, from entry to formal schools, Predeployment Training Program (PTP), and Professional Military Education. Assess the need for specific courses and opportunities for incorporating energy efficiency concepts into the existing curriculum. Initiation of this plan will begin NLT December 2013.

3. NLT July 2011, E2O, in coordination with DC Plans, Policies, and Operations (PP&O) and DC I&L, prepare a plan to incorporate an energy problem set into current wargames and exercises. The plan will identify where and how to inject energy as a factor in operational planning and execution scenarios. Issues to be addressed include—

    - ❍ **Validation of energy and water requirements, Table of Organization (T/O), Table of Equipment (T/E), and Equipment Density List (EDL)**
    - ❍ **Fuel and power demand as a CCIR**
    - ❍ **Risk to operations and tradeoffs in force protection and logistic resource requirements**
    - ❍ **Impact of energy requirements on logistic and operational planning.**

EQUIP

The Marine Corps' ability to meet the 2025 goals described in the USMC Expeditionary Energy Strategy will depend in large part on the ability to identify and develop technology and materiel requirements. These requirements must evolve into achievable materiel solutions that blend warfighting capability with energy efficiency.

We will develop strategic materiel initiatives over time aligned with our energy strategy goals. In the near term, we will prioritize initiatives with the greatest impact on energy efficiency and focus on modifying legacy equipment and modifying programs or technologies in the early phases of the acquisition lifecycle. These efforts will be part of a cluster of materiel initiatives to be implemented between now and 2015. Generators, environmental control units (ECU), computer hardware and shelters, and tactical vehicles are candidates for modifications or updates to yield immediate improvements in energy efficiency.

Longer term initiatives to enhance our ability to achieve our 2025 goals are part of a cluster of more sophisticated modifications to current programs, further development of technologies currently in R&D, and development of innovative and energy-efficient platforms and deployable renewable energy capabilities.

Near-Term Materiel Initiatives.

A. Make Energy Efficiency a Priority Requirement.

1. NLT May 2011, DC CD&I, in coordination with E2O, publish a plan to establish energy efficiency requirements built around systems and system sets to describe requisite system-level efficiencies. Similar requirements for energy efficiency and performance should be embedded into future capability development and requirements analysis.

2. NLT May 2011, DC CD&I, in coordination with E2O, assess and develop recommendations to implement energy efficiency in all acquisition development and analysis as part of EFDS capability evolution. Energy efficiency will be considered in the same trade space as cost, schedule, and performance. Requirements developers and acquisition professionals will analyze energy efficiency in materiel solutions to include at minimum, all weapons systems and platforms; air, ground and naval vehicles; C4I equipment; and shelter, water, waste, sustainment and life support systems and equipment. The assessment will address—

    - **Inclusion, where applicable, of the Energy Efficiency Key Performance Parameter (KPP) early in the concept and capability development phases of the requirements process**

    - **Requirements for operational energy performance attributes during CDD, CPD, and Statement of Needs development to influence the Materiel Development Decision (MDD), Analysis of Alternatives (AoA), and Technology Development Strategy (TDS) and to support subsequent KPP decisions**

    - **Identification of frameworks for capability sponsors to determine completeness and supportability of operational energy analysis documented in the CDD/CPD**

    - **Inclusion of the Energy Efficiency KPP in systems consistent with future force plans and approved planning scenarios; include operational fuel demand and related fuel logistics resupply risk considerations with a focus on mission success and reduction of the size of the fuel logistics force in the given planning scenarios**

    - **Methods of assessing lifecycle fuel use.**

B. Target Materiel Investments In High-Impact Areas.

1. NLT August 2011, E2O, in coordination with DC CD&I and Marine Corps Systems Command (MCSC), publish a roadmap and strategy to increase efficiency for legacy equipment, systems, and platforms and those currently under development. The plan will prioritize investments in program modification and upgrades based on criteria, such as potential effect on battlefield effectiveness and efficiency, cost/benefit, and potential effect on systems improvement. The plan will also address resource and budget requirements. This plan will be updated on an annual basis.

Long-Term Materiel and Technology Initiatives. This cluster of materiel initiatives will focus on Science and Technology (S&T) and R&D efforts. It will prompt the Marine Corps to drive capabilities of new programs yet to be fielded and identify innovative new technologies.

C. Focus Technology Innovation on Marine Corps Needs.

1. NLT April 2011, DC CD&I, in coordination with E2O, develop and issue an S&T investment priority framework to guide Marine Corps program elements and other elements of the Naval Research Enterprise supporting Marine Corps capability enhancements. This framework will also inform other S&T partners on Marine Corps S&T needs for energy efficiency across, at minimum, weapons systems and platforms; air, ground and naval vehicles; C4I equipment; shelter, water, waste, sustainment and life support systems and equipment.

2. NLT May 2011, E2O prepare and publish an annual comprehensive technology investment roadmap for expeditionary energy capabilities. Coordinate with DC CD&I, Marine Corps Warfighting Lab, Office of Naval Research, Defense Advanced Research and Development Agency (DARPA), and other Service labs.

D. Lead in Deploying Innovative Energy Solutions. We will establish the capability to identify energy-efficient technologies and solutions and renewable energy capabilities. We will rapidly transition technology from R&D to operational qualification. We will embrace new concepts and capabilities and employ them on the battlefield and in garrison.

1. NLT June 2011, DC DC&I, in coordination with MCSC, assess and develop a program plan to certify Marine Corps equipment on alternative fuels. This plan will track with Department of the Navy alternative fuel initiatives and program timelines.

2. NLT August 2011, E2O, in coordination with DC CD&I and MCSC, develop a program to capitalize on evolving technologies to increase use of local water resources and transition new capabilities to the battlefield.

- ❍ **Develop a plan that accounts for current technologies and anticipated developments by 2015 and beyond. This plan should include the anticipated results of transitioning to new lighter weight, transportable water purification technologies.**

- ❍ **Explore multiple technology initiatives related to grey water recycling, innovative water capture technology, water weight reduction, and field water certification and purification technology.**

3. NLT August 2011, E2O, in coordination with DC CD&I and MCSC, develop a program to capitalize on evolving technologies for waste management and waste-to-fuel capabilities and to transition those capabilities to the battlefield. This program will take a systems approach to addressing waste management on the battlefield.

    - ❍ **Develop a plan that accounts for current technologies and anticipated developments by 2015 and beyond.**

4. NLT August 2011, E2O, in coordination with DC CD&I and MCSC, develop a program to capitalize on evolving renewable energy technologies to identify and foster solutions for the expeditionary environment.

    - ❍ **Publish a plan that accounts for current technologies and anticipated developments by 2015 and beyond. It will identify opportunities for leveraging commercial innovation, federal government programs, academia, and national labs.**

Installations and GME

"To a Marine, the term "expeditionary' is more than a slogan; it is our state of mind."[4] Because we fight, train and live as an expeditionary force, this strategy encompasses not only our expeditionary edge but our installations and bases.

We must educate and inform everyone who lives, trains, and works on our installations—the energy users—about their daily impact on the energy footprint and then provide them with the tools to manage and improve their energy and water use. Awareness starts with an understanding of the value of energy, at home and to the mission, and ends with accountability.

The USMC Expeditionary Energy Strategy, as it applies to installations, is based on the CMC's *Facilities Energy and Water Management Program Campaign Plan ("Ten by '10")*. These goals, developed as a proactive response to federal energy and water mandates, set the Marine Corps on the path toward efficient and judicious use of resources.

The USMC Expeditionary Energy Strategy expands on the *Ten by '10*, incorporates commercial vehicle energy usage, and provides additional guidance and specific actions required to implement the strategy. There are five enabling concepts underpinning our installations' initiatives: awareness and accountability, performance measurement and improvement, energy efficiency as a component of planning, proactive employment of new technologies, and energy security and environmental stewardship.

The following guidance and tasks provide the path forward and the necessary support to meet our energy conservation and alternative energy mandates. These guidelines, tools, and actions are applicable to all Marine Corps organizations.

A. Instill Awareness of and Accountability for Energy, Fuel, and Water Usage in All Installation Users. Significant change in any organization cannot occur without engagement at all levels. Buy-in will not occur unless our Marines, their families, and the civilian workforce are educated on the relevance of energy management to the success of our mission.

DC I&L (LF):

1. Effective immediately, consider energy usage, energy conservation, and alternative energy sources in all USMC Environmental Assessments and Environmental Impact Statements, as appropriate and relevant to the analysis and selection of an action alternative, per the guidelines provided in Marine Corps Order (MCO) 5090.2A (series).

2. NLT June 2011, develop an execution plan to provide access to energy consumption data via geospatial information services (GIS) for MCIs, installation, and tenant unit leadership.

3. NLT July 2011, establish policy for reporting requirements to capture fuel usage, mileage, and cost data for all commercial vehicles through the Federal Automotive Statistical Tool (FAST).

4. NLT July 2011, develop and disseminate a Vehicle Allocation Methodology (VAM) and corresponding utilization study processes in order to ensure efficient use of GME assets, to include passenger, cargo, material handling, and engineering equipment.

5. NLT August 2011, update the Facilities and GME Energy Orders for review. The orders will provide policy and procedural instruction and guidance for addressing mandated energy and water management. Areas covered will include requirements pertaining to data collection and reporting, project development (including auditing and life cycle cost requirements) and execution, metering, benchmarking (e.g. Energy Star buildings), and training.

6. NLT October 2011, update IG inspection energy tab to incorporate provisions of the Expeditionary Energy Strategy.

HQMC DCs:

1. NLT March 2011, HQMC DCs assign a senior-level representative to address energy concerns from a functional perspective. Representatives will participate in E^2O Working Groups and provide functional expertise in the development and review of energy policy.

2. NLT June 2011, HQMC M&RA develop an Energy Plan for M&RA facilities consistent with federal and service goals. The plan should address recapitalization for improvements in energy conservation in existing facilities and operations.[5]

3. NLT June 2011, HQMC command, control, communications, and computers (C4) develop and publish an Energy Plan that will ensure C4 current and future operations, facilities, and equipment, including data centers, are operated in the spirit of this energy strategy.

MARFORs in Coordination with MCIs:6

1. Effective immediately, installations continue ongoing efforts to develop and conduct energy awareness programs throughout the year, specifically during the October Energy Awareness Month and on Earth Day.

2. Effective immediately, HQMC I&L Facilities and Services Division, Services Branch (LFS) and MCIs develop processes to assess and report commercial vehicle fleet utilization. Fleet managers identify and incorporate fleet efficiencies.

3. NLT March 2011, installations publish Commander's Energy Policy Statement. The statement will be based on the Expeditionary Energy Strategy, the *Ten by '10*, and other existing HQMC guidance and policy.

4. NLT March 2011, installations formally designate an Energy Manager. For smaller installations, this can be a primary collateral duty.

5. NLT March 2011, installations require all tenants and supported commands to identify an Energy Manager or representative at the individual unit or tenant level to coordinate unit and tenant involvement and actions as part of the installation's overall Energy Program.

6. NLT July 2011, and annually thereafter, installations require major tenants and supported commands (per Commanding Officer's discretion) to develop an energy program and provide annual performance data, as feasible, to the Installation Commander.

7. NLT October 2011, installations develop an installation-specific Energy Plan that will provide the basis for executing the Expeditionary Energy Strategy. This plan should be developed and executed in concert with the installation's Sustainability Plan and include energy and water

conservation, metering, energy demand planning, energy security, alternative and renewable energy development, and waste-to-energy considerations. It will also include specific provisions for energy awards and a recognition program for energy-efficient users.

8. NLT December 2012, or upon the completion of facility metering, installations implement a tenant/supported commander utilities monitoring and accountability program for installations energy.

B. Measure and Improve Energy and Water Performance. Measuring resource usage at installations allows us to measure progress against goals and mandates. Moreover, linking measurement to awareness programs via metering, digital dashboards, and other mechanisms reinforces education and training efforts.

DC I&L:

1. NLT May 2011, establish a standardized protocol for installations and MCIs to employ with energy metering and data collection and management systems. The protocol will plan for Energy Managers and Commanders to have the capability to access energy demand and consumption data from their desktop computers.

2. NLT May 2011, in coordination with the Secretary of the Navy (SECNAV) and Office of the Secretary of Defense (OSD) policy, complete analysis to determine whether there should be a Service-wide or regional position on renewable credits (REC).

3. NLT May 2011, in coordination with DC Aviation, assess and develop recommendations for upgrading existing airfield lighting aboard air stations with LED lighting. Determine plan for replacement.

DC Aviation:

1. NLT March 2011, develop a plan for incorporating LED technology into expeditionary airfield lighting. Include coordination with the Department of Defense, Department of Energy, and Federal Aviation Administration.

2. NLT May 2011, in coordination with Training and Education Command (TECOM), develop energy-saving procedures and identify alternative energy technologies to reduce cost of simulators and other high-energy demand supporting infrastructure.

3. NLT December 2011, develop policy to ensure infrastructure upgrades are identified for conversion to alternative fuels.

Installations in Coordination With MCIs:

1. Effective immediately, installations continue to phase out use of inefficient lighting (specifically incandescent and T12 lighting systems) using local funding and special projects.

2. Effective immediately, installations continue to minimize utility costs through demand shedding and peak shaving strategies. Review utility billing structure and incorporate improvements where feasible.

3. Effective immediately, Marine Forces Pacific (MARFORPAC) (OPR)/MCI West accelerate development of geothermal resources at the Marine Corps Air Ground Combat Center (MCAGCC) Twentynine Palms and Marine Corps Air Station (MCAS)Yuma, as feasible. Coordinate with Naval Facilities Engineering Command (NAVFAC) and TECOM.

4. NLT March 2011, installations complete plans to install meter and data collection and management systems by required deadline dates promulgated by DC I&L. Plans will be compatible with current architecture, historic preservation requirements, and systems.

5. NLT April 2011, and annually thereafter or as directed, installations conduct facility energy auditing to identify best return on investment projects for execution using lifecycle cost analysis. Analyses will include projects for energy conservation improvement, building recommissioning, and development of alternative and renewable energy projects.

6. NLT December 2011, installations evaluate transportation needs and audit current practices and metering.

C. Transition Energy Efficiency From Discretionary to Mandatory in Planning, Decisions, and Actions. Energy performance must be a primary consideration in all aspects of planning, decisionmaking, and execution of the Marine Corps mission—both deployed and at home. Energy planning includes conservation efforts through behavior change and physical improvements to facilities and infrastructure, as well as the implementation of alternative and renewable energy sources.

Energy planning is a key component of installation sustainability planning, which also accounts for water and resource conservation, waste diversion through residential and industrial recycling, waste-to-energy initiatives, and waste stream minimization through procurement of sustainable supply chain products. All new initiatives will be completed in compliance with existing federal statutes on environmental protection.

DC I&L:

1. Effective immediately, establish policy directing installations to immediately institute the achievement of Leadership in Energy and Environmental Design (LEED) silver for new facilities as a non-wavering minimum. Maximize energy to include renewable LEED points. Policy will define cost threshold for new facilities. (Coordinate with NAVFAC.)

2. NLT August 2011, in coordination with NAVFAC, develop responsive contracting tools to support the rapid implementation of proven technologies with demonstrated cost-benefit analysis.

3. NLT September 2011, develop guidance for incorporating the evaluation of alternative and renewable energy sources into the Master Planning Process as they relate to encroachment buffers and to support energy security.

DC M&RA:

1. NLT January 2012, in coordination with MCIs and installations, develop Sustainability Plans for all M&RA facilities that include, at a minimum, energy and water conservation, metering, energy demand planning, waste-to-energy considerations, recycling, waste minimization from the supply chain through sustainable products, and landfill diversion.

MARFORs in Coordination With MCIs:

1. Effective immediately, installation environmental proponents consider energy usage, energy conservation, and alternative energy sources in all Environmental Assessments and Environmental Impact Statements prepared under the National Environmental Policy Act (NEPA), per HQMC guidance subject to MCO 5090.2A (series).

2. Effective immediately, ensure energy efficiency is included in all contracted services. (Coordinate with NAVFAC.)

3. NLT March 2011, installations procure material that is energy efficient (ENERGY STAR or equivalent) and environmentally preferable, including purchase card procurements.

4. NLT May 2011, Marine Corps Logistics Base (MCLB) Barstow and MCAS Miramar update Green Base template execution plan. Nominate additional bases with promising energy profiles and programs for inclusion in Green Base program.

5. NLT May 2011, installations develop a plan for renewable energy infrastructure to support charging and fueling of commercial vehicle fleets. Consideration should also be given to the potential to scale facilities to support private vehicles used for personal transportation in support of greenhouse gas reduction efforts by individuals for personal transportation needs.

D. Demonstrate Leadership by Quickly and Proactively Adopting New Technologies. Rapid transition of promising and proven technology from R&D to operational qualification is a key indicator of a robust innovation pipeline within the Marine Corps.

DC I&L:

1. Effective immediately, communicate lessons learned related to effective energy management to E2O.

2. Effective immediately, identify and promote game-changing technologies and projects through the Facilities Operations Advisory Group and its associated Energy Working Group.

MARFORs in Coordination With MCIs:

1. Effective immediately, installations encourage, provide incentives for, and recognize incorporation of new technologies that reduce energy demand.

2. NLT January 2012, installations include Microgrid or Smart Grid transition planning in their Energy and Sustainability Plans.

E. Maintain Energy Security and Environmental Stewardship to Support Installation Mission and Sustainment. Planning for and achieving incremental steps toward total energy security enables our bases and installations to continue to prepare Marines for combat operations without mission interruption. Reducing emissions and reliance on fossil fuels and continuing to adopt sustainable practices demonstrate the Marine Corps' strong commitment to the community and leadership in environmental stewardship.

To quickly and proactively adopt new technologies, we must be proactive with respect to environmental review and planning in support of selecting and implementing new technologies. Environmental reviews and compliance actions can be a critical element in accomplishing a project goal and can ensure we comply with applicable laws and identify unanticipated consequences.

DC I&L:

1. NLT June 2011, in coordination with DC PPO, define energy security and energy surety. Provide policy and guidance to MARFORs and MCIs for inclusion in regional and installation ATFP and Sustainability Plans.

2. NLT June 2011, develop a strategy to achieve net-zero energy at targeted installations. Strategy will consider centralized management of renewable energy projects.

3. NLT January 2012, develop policy and guidance for incorporating environmental considerations into energy decisions (e.g., greenhouse gas emissions reductions) and CMC policy on sustainability.

MARFORs in Coordination With MCIs:

1. NLT January 2012, in conjunction with Sustainability Plan development, installations examine and develop an Energy Security Plan that addresses the continuous support of critical facilities and infrastructure during a natural or man made disaster.

2. NLT January 2012, installations promote renewable energy sources and reduction of greenhouse gas emissions. The Sustainability Plan specifically addresses this subject.

Endnotes

[1] NDAA 2009

[2] These systems may include Global Combat Support Systems (GCSS), Global Command and Control Systems (GCCS), DRRS, FSMAO Reports, Future Reporting Systems, Fitness Reports (FITREPS), Aviation Management Supply and Readiness Reporting (AMSRR), Naval Tactical Command Support System (NTCSS, OOMA/OIMA), and Aircraft Inventory Readiness and Reporting System (AIRRS) data in the Naval Aviation Logistics Data Analysis (NALDS) Integrated Data Environment (IDE).

[3] Requirements may include: Joint equipment and weapons systems and sustainment logistics practices, such as Logistics Civil Augmentation Program (LOGCAP) process; sustainable expeditionary base camp design and management; and alternative fuels employment.

[4] 35th Commandant of the Marine Corps *Commandant's Planning Guidance 2010*.

[5] Facilities constructed with non-appropriated funds (NAF) are turned over to installation commanders and become the property of the U.S. Government (MCO P1700.27B, paragraph 9208). There is an appropriated fund requirement for support of Facility Sustainment, Restoration, and Modernization (FSRM) requirements for NAF-constructed facilities. This is in addition to any NAF-supported funding requirements for those facilities.

[6] For the purposes of this strategy, MARFORs refers to the major Marine Corps commands and extends to commands with command of Marine Corps installations. Marine Corps installations include facilities or land leased or owned by the Marine Corps. This does not apply where Marine Corps activities are housed either on another Service's installation (e.g., Marine Forces Africa) or in a Joint facility.

Annex B
Mandates, Direction and Guidance

SECNAV Energy Goals

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

"*The Department of the Navy's Energy Program for Security and Independence*," The Secretary of the Navy 2010.

Mandates / Installations and Commercial Vehicle Fleet

Focus Area	Statute / Executive Order	Provisions
Acquisition of Alternative Fuels and Energy Efficient Products	Executive Order 13514 October 2009	• Advance sustainable acquisition to ensure that 95 percent of new contract actions including task and delivery orders, for products and services with the exception of acquisition of weapon systems, are energy-efficient (Energy Star or Federal Energy Management Program (FEMP) designated), water-efficient, biobased, environmentally preferable (e.g., Electronic Product Environmental Assessment Tool (EPEAT) certified), non-ozone depleting, contain recycled content, or are nontoxic or less-toxic alternatives, where such products and services meet agency performance requirements Sec. 2(h)
	Energy Independence and Security Act of 2007	• To meet the requirements of an agency for an energy consuming product in a product category covered by the Energy Star program or the Federal Energy Management Program (FEMP) for designated products, the head of the agency shall procure an Energy Star product or a FEMP designated product (Sec. 525(a)(1) and (2)) • No Federal agency shall enter into a contract for procurement of an alternative or synthetic fuel, including a fuel produced from nonconventional petroleum sources, for any mobility-related use, other than for research or testing, unless the contract specifies that the lifecycle greenhouse gas emissions associated with the production and combustion of the fuel supplied under the contract must, on an ongoing basis, be less than or equal to such emissions from the equivalent conventional fuel produced from conventional petroleum sources (Sec. 256)
Greenhouse Gas Emission Reduction Greenhouse Gas Emission Reduction	Executive Order 13514 October 2009	• Establish and report an agency-wide greenhouse gas (GHG) emissions inventory and percentage reduction target (scope 1, scope 2, and specified scope 3 emissions) by FY2020, relative to FY2008 baseline Sec. 2(a)

Mandates / Installations and Commercial Vehicle Fleet (cont.)

Focus Area	Statute / Executive Order	Provisions

Energy Efficiency and Energy Consumption	Executive Order 13514 October 2009	• Implement high-performance sustainable Federal building design, construction, operation and management, maintenance, and deconstruction including:
		  • Beginning in 2020, ensure new buildings are designed to achieve net-zero energy by 2030
		  • Ensure that at least 15 percent of existing buildings and building leases (> 5,000 gross square feet) meet the Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings by FY 2015
		Sec 2(g)

	Executive Order 13423 January 2007	• Improve energy efficiency through reduction of facility energy intensity (MMBtu/square foot) 3% annually and 30% by end of FY2015 from a FY2003 baseline Sec. 2(a)
	Energy Independence and Security Act of 2007	• Reduce total energy use in federal buildings 3% annually and 30% by 2015 from a FY2003 baseline • Not later than October 1, 2016, each agency shall provide for equivalent metering of natural gas and steam Sec. 431
	Energy Policy Act of 2005	• By October 1, 2012, all Federal buildings shall, for the purposes of efficient use of energy and reduction in the cost of electricity used in such buildings, be metered Sec. 103(e)(1)

Renewable Energy	Energy Policy Act of 2005	Renewable energy purchase requirement:
		  • ≥ 3% for FY2007-FY2009
		  • ≥ 5% for FY2010-FY2012
		  • ≥7.5% for FY2013 and each fiscal year thereafter
		Sec. 203(a)(1-3)

	National Defense Authorization Act 2007	• Produce or procure ≥25% of the total quantity of electric energy from renewable energy sources beginning in 2025 Sec. 2852
	Executive Order 13423 January 2007	• Consume ≥ 50% of renewable energy from new renewable sources (Sec.2(b)) • Implement renewable energy generation projects on agency property for agency use (Sec. 2 (b))

Mandates / Installations and Commercial Vehicle Fleet (cont.)

Focus Area	Statute / Executive Order	Provisions
Vehicle Petroleum Consumption	Executive Order 13514 October 2009	Reduce the use of fossil fuels by: • Using low greenhouse gas emitting vehicles in the agency fleet; • Optimizing the number of vehicles in the agency fleet; • Reducing the agency fleet's total consumption of petroleum products by a minimum of 2% annually through the end of FY2020, relative to baseline FY2005 Sec. 2(a)(iii)
	Energy Independence and Security Act of 2007	• Beginning in FY2010, each Federal agency shall reduce petroleum consumption and increase alternative fuel consumption to meet the following goals: • No later than Oct. 1, 2015, each Federal agency shall achieve ≥ 20% reduction in annual petroleum consumption and a 10% increase in annual alternative fuel consumption, relative to FY2005 baseline. • Alternative fuels cannot be used if lifecycle greenhouse gas emissions are greater than emissions from conventional petroleum sources. Sec. 142(a)(2)
	Executive Order 13423 January 2007	• Increase the total fuel consumption that is non-petroleum-based by 10 percent annually • Use plug-in hybrid (PIH) vehicles when PIH vehicles are commercially available at a cost reasonable comparable, on the basis of life-cycle cost, to non-PIH vehicles Sec. 2(g)
Energy Security	National Defense Authorization Act 2009	• Conduct study and develop risk mitigation plans to address risk of extended power outages resulting from failure of the commercial electricity supply or grid and related infrastructure. Sec. 335

Direction and Guidance/ Operational Energy

Statute/Policy	Provisions
2010 Quadrennial Defense Review	• Asserts that DoD will fully implement the energy efficiency KPP and fully burdened cost of fuel methodologies required by the NDAA 2009 Page 87
NDAA 2009	• Requires an annual report on operational energy management and implementation of DoD operational energy strategy, to include statistical information on energy demand and consumption (Sec. 33) • Requires analyses and force planning processes to consider the requirements for, and vulnerability of, fuel logistics (Sec. 332) • Requires a fuel efficiency key performance parameter (KPP) in the requirements development process, for the modification of existing or development of new fuel consuming systems (Sec. 332) • Requires that life cycle cost analysis for new systems include calculation of the fully burdened cost of fuel (FBCF) during Analysis of Alternatives (AoA) and evaluation of alternatives and acquisition program design trades (Sec. 332) • Requires DoD to conduct a study to examine the feasibility of using solar and wind energy to provide electricity for expeditionary forces (Sec. 332)
NDAA 2007	Directs the DoD to improve the fuel efficiency of weapons platforms, consistent with mission requirements, in order to: 1. Enhance platform performance; 2. Reduce the size of the fuel logistics systems; 3. Reduce the burden of high fuel consumption places on agility; 4. Reduce operating costs; and 5. Dampen the financial impact of volatile oil prices. Sec. 360
DoD Instruction 5000.02: Operation of the Defense Acquisition System December 2008	• Directs that AoAs assess alternative ways to improve energy efficiency Page 59
CJCSI 3170.01G: Manual for Operation of the Joint Capabilities Integration and Development System February 2009	Establishes energy efficiency as a new, selectively applied Key Performance Parameter

Annex C
The USMC Energy Profile

The USMC Energy Profile

Energy is a mission critical requirement for Marine Corps expeditionary and garrison operations. Knowing where and how the Marine Corps uses energy establishes baselines for measuring progress towards our strategic energy goals, SECNAV goals, federal statutes, executive orders, and DoD policy. Importantly, this insight will make it possible to target efficiency gains that translate to increased energy efficiency, reduced consumption, and ultimately a lighter and faster Marine Corps.

Expeditionary Profile

The Marine Corps consumes more than five million barrels of petroleum a year—or about 16% of the total consumption of the Department of the Navy. (Fig. 1)

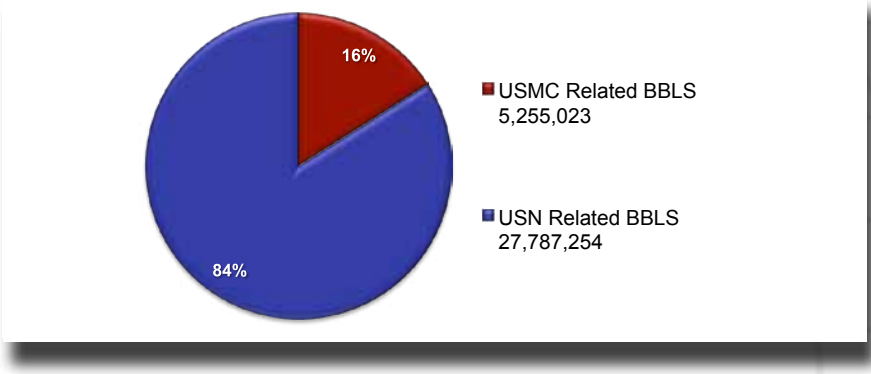


Fig.1 FY 09 DON Petroleum Consumption

Ninety-seven percent of the Marine Corps' share is used for operational purposes—fuel for training, moving and sustaining our forces, aircraft and weapons platforms.[1] Within this, and historically since 2005, aviation requires about 75% of the total, with tactical ground activities using the remaining 25%.[2] (Fig. 2)

Detailed data on how fuel is used—from the bulk distribution point to the unit level—is not routinely collected and reported within the Marine Corps today. To address this critical information gap, the USMC Expeditionary Energy Strategy calls for establishing the capability to capture, report and analyze energy demand and consumption data by 2015.

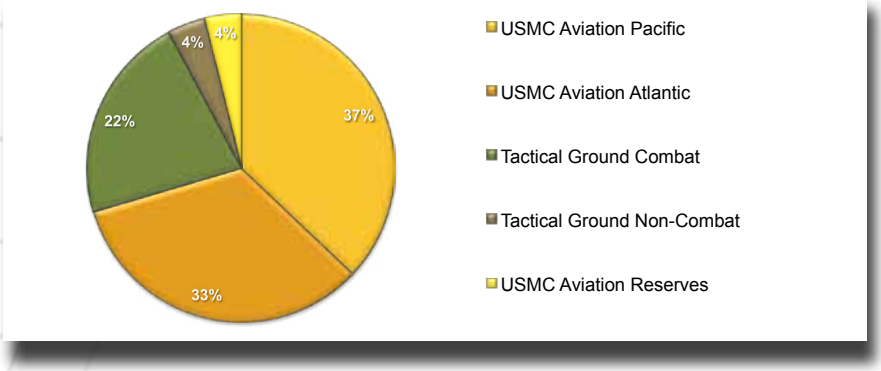


Fig. 2 FY 09 USMC Operational Fuel Use, 4.9M BBLS

In the interim, analyzing snapshots of data—such as bulk fuel planning factors, spot data on actual use, and electrical energy requirements of equipment and systems—provides a starting point for assessing the challenges and opportunities in achieving our energy goals.

For example, using Notional Fuel Requirements for a Marine Expeditionary Brigade (MEB), the daily planned consumption of fuel to support the MAGTF is approximately 530,000 gallons.[3] Of this 78% is consumed by the Aviation Combat Element the remaining elements of the MEB consume 22% of the daily fuel requirement. (Fig. 3)

Because Marine Air-Ground Task Force (MAGTF) operations are task-organized for specific missions, the platforms and equipment employed, and thus the energy demand footprint, varies widely depending on the task and configuration for the operation.

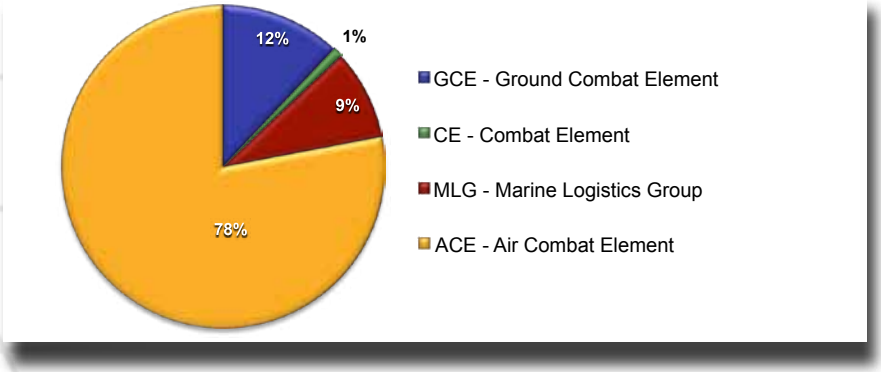


Fig. 3 Notional Fuel Requirements, MEB

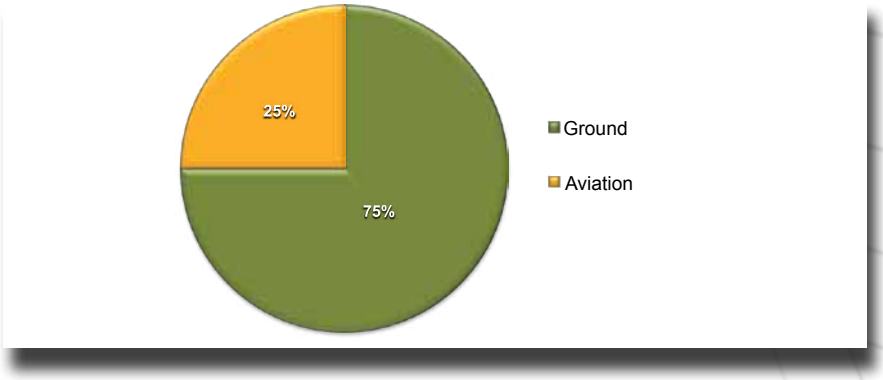


Fig. 4 I-MEF (FWD) Bulk Fuel Consumption, June 2010

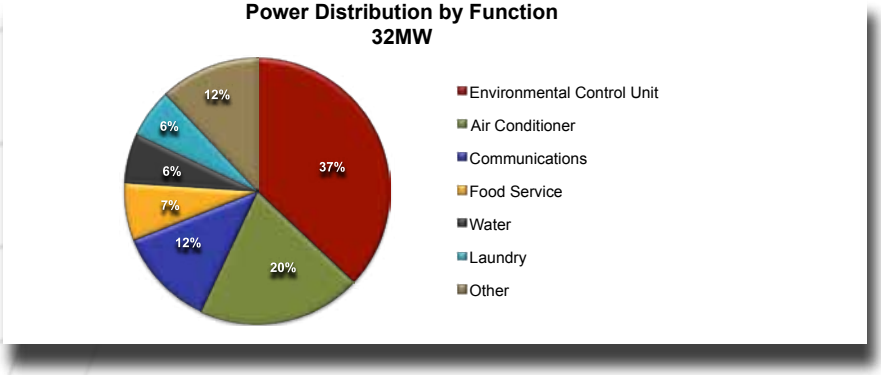
Actual fuel consumption data from 1st Marine Expeditionary Force (I-MEF) Forward (FWD) illustrates a different demand profile, reflecting the MAGTF configuration for the mission in Afghanistan (Fig. 4). In June 2010, the daily consumption of fuel to support operations in Afghanistan totaled approximately 200,000 gallons. Of this 75% was consumed by 'ground forces,' which includes use by vehicles, generators, and other sustainment equipment. Aircraft consumed approximately 25% of the total.[4]

Of the 75% consumed by 'ground forces,' a significant portion is used to generate electricity. A breakdown of this category is not available for I-MEF (FWD). However, using the demand profile (in kilowatts, or kW) of equipment requirements of a deployed MEF provides us a proxy measure for power and fuel demand.

Figure 5 shows electrical power demand across the top ten systems and equipment users, and across the elements of the MAGTF.[5] More than 57% of equipment power demand is from Environmental Conditioning Units (ECU) and Air Conditioners, followed by 12% for communications related equipment.

Data from the Marine Expeditionary Brigade-Afghanistan (MEB-A) in August 2009, provides another snapshot of fuel demand to support electrical generation on the battlefield: of the total 88,749 gallons per day of fuel used by MEB-A, 32% was consumed for electrical power generation.[6] (Fig. 6)

Additional data from the Marine Corps' 2003 MEF Fuel Use Reduction study provides insight into fuel used by tactical vehicles during the operations in Iraq. Almost 90% of the fuel used by MEF ground vehicles was for Tactical Wheeled Vehicles, including High Mobility



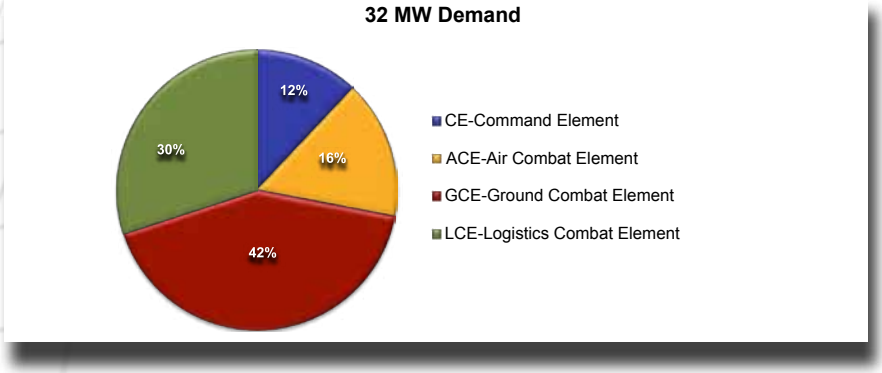


Fig. 5 Sample MEF Energy Demand by MAGTF Element and Equipment Function

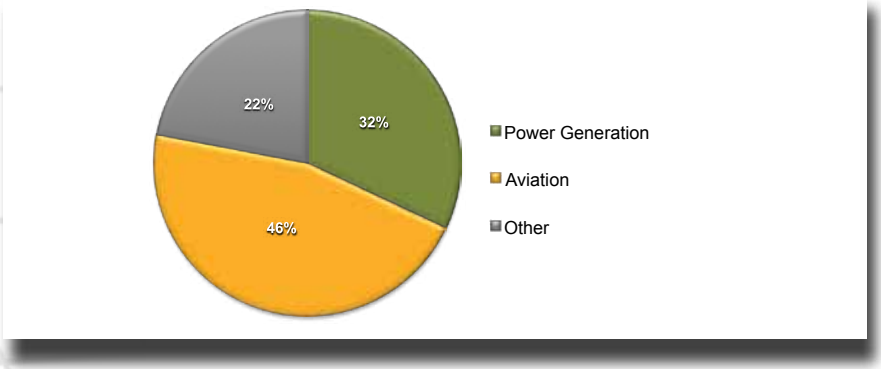


Fig. 6 MEB-A Bulk Fuel Consumption, August 2009

Multi-Purpose Wheeled Vehicles (HMMWVs), medium trucks, and the Logistics Vehicle System (LVS). The study showed conclusively that the armored weapon vehicles, e.g., the M1 tanks, Light Armored Vehicles (LAVs) and Amphibious Assault Vehicles (AAVs), although fuel intense systems, as a fleet these vehicles consumed a relatively minor fraction of the fuel apportioned to MEF ground vehicles.[7]

Installations Profile

We have a more detailed data picture for our Installations and GME. Figure 7 presents Marine Corps Installations consumption and cost data by fuel type for 2009. Annual consumption for 2009 was 10.6 million MBTU, 48% of that amount was electricity, and 30% was natural gas. Electricity had the greatest cost totaling more than 77% of the total cost burden.[8]

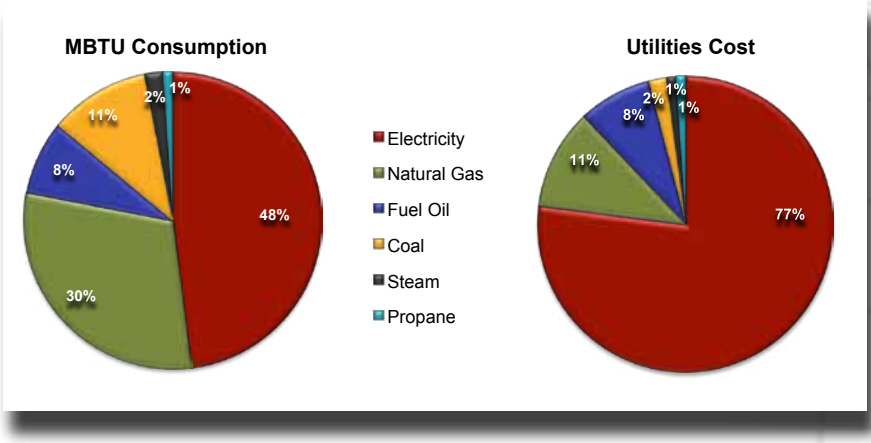


Fig. 7 USMC Installations Energy Consumption and Cost Profile, 2009

The Marine Corps has 22 major installations and a land area of 2.3 million acres. Camp Lejeune represents about 25% of the total MBTU consumption, with Quantico, Cherry Point and Parris Island an additional 20%. The East Coast Facilities have higher humidity control and heating requirements than comparable facilities on the West Coast.

Energy generated via renewable sources on our installations is approximately 5% of total power requirements (measured at peak production).

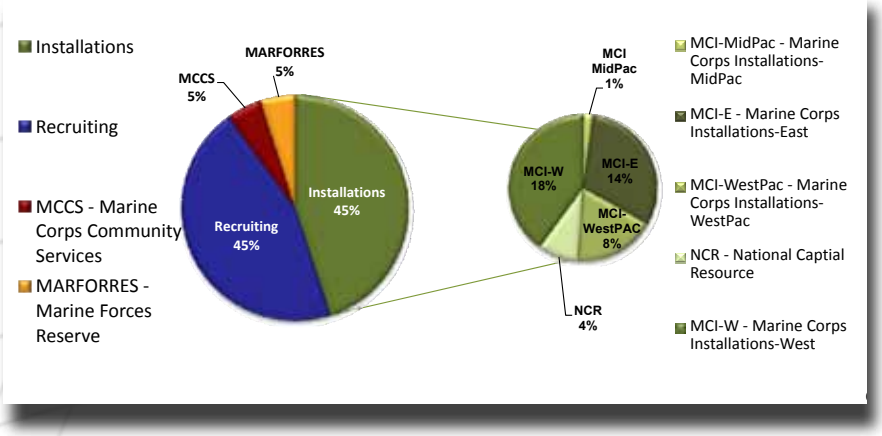


Fig. 8 USMC Commercial Vehicle Petroleum Consumption

Garrison Mobile Equipment used about 7.1M Gals in 2009, over a total vehicle fleet of 14,233 vehicles. The fleet also included 2,868 alternative fuel vehicles. Figure 8 presents a snapshot of petroleum consumption by the fleet, by end user and distribution across installations.[9]

Endnotes

[1] NDAA 2009 defines operational energy as the "energy required for training, moving, and sustaining military forces and weapons platforms for military operations. The term includes energy used by tactical power systems and generators and weapons platforms."

[2] Estimates for operational fuel use in Figures 1 and 2 are based on an initial analysis of DLA-Energy data on petroleum use, analyzed by DODAAC. Available data for each year back to 2005 show aviation use at about 75% of the total, with ground activities at about 25%.

[3] I MEF, October 2010.

[4] MEF-A REPOL, Bulk Petroleum Contingency Report, June 2010.

[5] Based on the Table of Equipment for I-MEF (FWD) as of May 2010. Reflects the total potential kW demand of each piece of equipment; assumes the equipment is fully employed and optimized.

[6] Report of the Marine Expeditionary Energy Assessment Team, August 2009; data provided by MEB-A Bulk Fuels Officer.

[7] Office of the Assistant Secretary of the Navy (Research, Development & Acquisition), Naval Research Advisory Committee Report, Future Fuels, April 2006.

[8] Data in this section based on FY 2009 Q4 DUERS, compiled by HQMC Installations & Logistics, Facilities Branch, (LFF).

[9] HQMC Installations & Logistics, Services Branch, LFS. July 2010.

Annex D
Definitions and References

Definitions

USMC Terms

Advocate: Assists each element in identifying capabilities, deficiencies, and issues and ensures those issues are advanced through various processes within the Expeditionary Force Development Systems (EFDS) and the Department of the Navy. The advocate acts as a conduit between the Operating Forces/Supporting Establishment and the various process owners within the EFDS, as well as those external to the Marine Corps, to ensure that element's interests are properly addressed. The advocate is both the single point of contact in the National Capital Region for oversight of that element's issues and the single voice, absent the commander or his designee, in representing those issues to the Marine Corps leadership.

a. ***MAGTF Advocate:*** The Commandant's primary point of contact on one of the four specific elements of the Marine Air-Ground Task Force (MAGTF) (CE-DC CD&I, GCE-DC PP&O, ACE-DC AVN, LCE/SE-DC I&L) who is responsible for all organizational and functional matters pertaining to that MAGTF element.

b. ***Functional Advocate:*** The Commandant's primary point of contact for a specific Marine Corps function (Fires-DC PP&O, Maneuver-DC PP&O, Force Protection-DC PP&O, Logistics-DC I&L, Intelligence-Dir Intel, C4I-Director C4, Legal-SJA, Public Affairs-Dir PA, Fiscal-DC P&R, Personnel-DC M&RA, Acquisition-CG MCSC, Training-CG TECOM) that supports the elements of the MAGTF. (TFSP)

Aviation Combat Element (ACE): The core element of a MAGTF that is task-organized to conduct aviation operations. The ACE provides all or a portion of the six functions of Marine aviation necessary to accomplish the MAGTF's mission: antiair warfare, offensive air support, assault support, electronic warfare, air reconnaissance, and control of aircraft and missiles. The ACE usually comprises an aviation unit headquarters and various other aviation units or their detachments. It can vary in size from a small aviation detachment of specifically required aircraft to one or more Marine aircraft wings. In a Joint or multinational environment, the ACE may contain other Service or multinational forces assigned or attached to the MAGTF. The ACE itself is not a formal command. (MCRP 5-12C)

Battlespace: All aspects of the air, surface, subsurface, land, space, and electromagnetic spectrum that encompass the area of influence and area of interest. (MCRP 5-12C)

Capability: The ability to achieve a desired effect under specified standards and conditions through combinations of means and ways across the doctrine, organization, training, materiel, leadership and education, personnel, and facilities (DOTMLPF) to perform a set of tasks to execute a specified course of action. It is defined by an operational user and expressed in broad operational terms in the format of an initial capabilities document or a Joint DOTMLPF change recommendation. In the case of materiel proposals/documents, the definition will progressively evolve to DOTMLPF performance attributes identified in the capability development document and the capability production document. (CJCSI 3170.01G)

Civil-Military Operations (CMO): The activities of a commander that establish, maintain, influence, or exploit relations between military forces, governmental and nongovernmental civilian organizations and authorities, and the civilian populace in a friendly, neutral, or hostile operational area in order to facilitate military operations and to consolidate and achieve operational U.S. objectives. CMO may include performance by military forces of activities and functions normally the responsibility of the local, regional, or national government. These activities may occur before, during, or after other military actions. They may also occur, if directed, in the absence of other military operations. CMO may be performed by designated civil affairs, other military forces, or a combination of civil affairs and other forces. (JP 1-02)

Combatant Command: A unified or specified command with a broad continuing mission under a single commander established and so designated by the President, through the Secretary of Defense and with the advice and assistance of the Chairman of the Joint Chiefs of Staff. Combatant commands typically have geographic or functional responsibilities. (JP 1-02)

Combatant Commander (CCDR): A commander of one of the unified or specified combatant commands established by the President. (JP 1-02)

Combat Power: The total means of destructive and/or disruptive force that a military unit/formation can apply against the opponent at a given time. (JP 1-02)

Command Element (CE): The core element of a MAGTF that is its headquarters. The CE comprises the commander; general or executive and special staff sections; the headquarters section; and requisite communications support, intelligence, and reconnaissance forces necessary to accomplish the MAGTF's mission. The CE provides command and control, intelligence, and other support essential for effective planning and execution of operations by the other elements

of the MAGTF. The CE varies in size and composition; in a Joint or multinational environment, it may contain other Service or multinational forces assigned or attached to the MAGTF. (MCRP 5-12C)

Concept of Operations (CONOPS): A verbal or graphic statement, in broad outline, of a commander's assumptions or intent in regard to an operation or series of operations. The CONOPS frequently is embodied in campaign plans and operation plans; in the latter case, particularly when the plans cover a series of connected operations to be carried out simultaneously or in succession. The concept is designed to give an overall picture of the operation. It is included primarily for additional clarity of purpose. Also called a commander's concept. (CJCSI 3170.01G)

Conventional Forces: 1. Those forces capable of conducting operations using non-nuclear weapons. 2. Those forces other than designated special operations forces. (JP 1-02)

Counterinsurgency: Those military, paramilitary, political, economic, psychological, and civic actions taken by a government to defeat insurgency. Also called COIN. (JP 1-02)

Equipment: In logistics, all nonexpendable items needed to outfit or equip an individual or organization. (JP)

Expeditionary Force: An armed force organized to accomplish a specific objective in a foreign country. (JP 1-02)

Ground Combat Element (GCE): The core element of a MAGTF that is task-organized to conduct ground operations. It is usually constructed around an infantry organization but can vary in size from a small ground unit of any type to one or more Marine divisions that can be independently maneuvered under the direction of the MAGTF commander. It includes appropriate ground combat and combat support forces; in a Joint or multinational environment, it may also contain other Service or multinational forces assigned or attached to the MAGTF. The GCE itself is not a formal command. (MCRP 5-12C)

Intelligence, Surveillance, and Reconnaissance (ISR): An activity that synchronizes and integrates the planning and operation of sensors; assets; and processing, exploitation, and dissemination systems in direct support of current and future operations. This is an integrated intelligence and operations function. (JP 1-02)

Interagency: U.S. government agencies and departments, including the Department of Defense. See also interagency coordination. (JP 1-02)

Irregular Challenges: Challenges posed by those employing unconventional methods to counter the traditional advantages of stronger opponents. (NDS)

Irregular Warfare (IW): A violent struggle among state and non-state actors for legitimacy and influence over the relevant population(s). IW favors indirect and asymmetric approaches, but it may employ the full range of military and other capacities to erode an adversary's power, influence, and will. (JP 1-02)

Joint: Connotes activities, operations, organizations, etc., in which elements of two or more military departments participate. (JP 1-02)

Joint Force: A general term applied to a force composed of significant elements, assigned or attached, of two or more Military Departments operating under a single Joint force commander. (CJCSI 3170.01G)

Joint Mission Environment: A subset of the Joint operational environment comprising force and non-force entities, conditions, circumstances, and influences within which forces employ capabilities to execute Joint tasks to meet a specific mission objective. (CJCSI 3170.01G)

Joint Operational Environment: The environment of land, sea, and/or airspace within which a Joint force commander employs capabilities to execute assigned missions. (CJCSI 3170.01G)

Joint Urgent Operational Need (JUON): An urgent operational need identified by a combatant commander involved in an ongoing named operation. A JUON's main purpose is to identify and subsequently gain Joint Staff validation and resourcing solution, usually within days or weeks, to meet a specific high-priority combatant commander need. The scope of a combatant commander JUON will be limited to addressing urgent operational needs that (1) fall outside of the established Service processes and, (2) most importantly, if not addressed immediately, will seriously endanger personnel or pose a major threat to ongoing operations. A JUON should not involve the development of a new technology or capability; however, the acceleration of a Join Capability Concept Demonstration (JCTD) or minor modification of an existing system to adapt to a new or similar mission is within the scope of the JUON validation and resourcing process. (CJCSI 3170.01G)

Littoral: Comprises two segments of battlespace: seaward and landward. 1. Seaward: The area from the open ocean to the shore that must be controlled to support operations ashore. 2. Landward: The area inland from the shore that can be supported and defended directly from the sea. (JP 1-02)

Logistics Combat Element (LCE): The core element of a MAGTF that is task-organized to provide the combat service support necessary to accomplish the MAGTF's mission. The LCE varies in size from a small detachment to one or more Marine logistics groups. It provides supply, maintenance, transportation, general engineering, health services, and a variety of other services to the MAGTF. In a Joint or multinational environment, it may also contain other Service or multinational forces assigned or attached to the MAGTF. The LCE itself is not a formal command. (MCRP 5-12C)

Maneuver: 1. A movement to place ships, aircraft, or land forces in a position of advantage over the enemy. 2. A tactical exercise carried out at sea, in the air, on the ground, or on a map in imitation of war. 3. The operation of a ship, aircraft, or vehicle to cause it to perform desired movements. 4. Employment of forces in the operational area through movement in combination with fires to achieve a position of advantage in respect to the enemy in order to accomplish the mission. (JP 1-02)

Maneuver Warfare: A warfighting philosophy that seeks to shatter the enemy's cohesion through a variety of rapid, focused, and unexpected actions that create a turbulent and rapidly deteriorating situation with which the enemy cannot cope. (MCRP 5-12C)

Marine Air-Ground Task Force (MAGTF): The Marine Corps' principal organization for all missions across the range of military operations, comprising forces task-organized under a single commander capable of responding rapidly to a contingency anywhere in the world. The types of forces in the MAGTF are functionally grouped into four core elements: a command element, an aviation combat element, a ground combat element, and a logistics combat element. The four core elements are categories of forces, not formal commands. The basic structure of the MAGTF never varies, but the number, size, and type of Marine Corps units within each of its four elements will always be mission dependent. The flexibility of the organizational structure allows one or more subordinate MAGTFs to be assigned. In a Joint or multinational environment, other Service or multinational forces may be assigned or attached. (MCRP 5-12C)

Marine Aviation Functions: The six functions (antiair warfare, offensive air support, assault support, electronic warfare, air reconnaissance, and control of aircraft and missiles) performed by Marine aviation in support of the MAGTF. (MCRP 5-12C)

Marine Expeditionary Brigade (MEB): A MAGTF constructed around a reinforced infantry regiment, a composite Marine aircraft group, and a combat logistics regiment. The MEB, commanded by a general officer,

is task-organized to meet the requirements of a specific situation. It can function as part of a Joint task force, as the lead echelon of the Marine expeditionary force (MEF), or alone. It varies in size and composition and is larger than a Marine expeditionary unit (MEU) but smaller than a MEF. The MEB is capable of conducting missions across the full range of military operations. In a Joint or multinational environment, it may also contain other Service or multinational forces assigned or attached to the MAGTF. (MCRP 5-12C)

Marine Expeditionary Force (MEF): The largest MAGTF and the Marine Corps' principal warfighting organization, particularly for larger crises or contingencies. It is task-organized around a permanent command element and normally contains one or more Marine divisions, Marine aircraft wings, and Marine logistics groups. The MEF is capable of missions across the range of military operations, including amphibious assault and sustained operations ashore in any environment. It can operate from a sea base, a land base, or both. In a Joint or multinational environment, it may also contain other Service or multinational forces assigned or attached to the MAGTF. (MCRP 5-12C)

Marine Expeditionary Unit (MEU): A MAGTF constructed around an infantry battalion reinforced, a helicopter squadron reinforced, and a task-organized logistics combat element. It normally fulfills Marine Corps' forward sea-based deployment requirements. The MEU provides an immediate reaction capability for crisis response and is capable of limited combat operations. In a Joint or multinational environment, it may contain other Service or multinational forces assigned or attached to the MAGTF. (MCRP 5-12C)

Maritime Prepositioning Force (MPF): A task organization of units under one commander formed for the purpose of introducing a MAGTF and its associated equipment and supplies into a secure area. The MPF comprises a command element, a maritime prepositioning ships squadron, a MAGTF, and a Navy support element. (MCRP 5-12C)

Materiel: All items (including ships, tanks, self-propelled weapons, aircraft, etc., and related spares, repair parts, and support equipment, but excluding real property, installations, and utilities) necessary to equip, operate, maintain, and support military activities without distinction as to its application for administrative or combat purposes. (JP)

Mobility: A quality or capability of military forces which permits them to move from place to place while retaining the ability to fulfill their primary mission. (JP 3-17)

Multicapable: Operationally decisive across the range of military operations with a capacity tailored to combatant commanders' requirements; optimized to operate as an integrated system through the air, land, and maritime domains. (Proposed for inclusion in the next edition of MCRP 5-12C)

Multinational: Between two or more forces or agencies of two or more nations or coalition partners. (JP 1-02)

Multinational Force (MNF): A force comprising military elements of nations who have formed an alliance or coalition for some specific purpose. (JP 1-02)

Overseas: All locations, including Alaska and Hawaii, outside the continental United States. (JP 1-02)

Professional Military Education (PME): The systematic instruction of professionals in subjects that will enhance their knowledge of the science and art of war. (MCRP 5-12C)

Sea Base: An inherently maneuverable, scalable aggregation of distributed, networked platforms that enables the global power projection of offensive and defensive forces from the sea and includes the ability to assemble, equip, project, support, and sustain those forces without reliance on land bases within the Joint operations area. (NTRP 1-02)

Seabasing: A national capability and overarching transformational operating concept for projecting and sustaining U.S. Marine Corps (USMC) power and Joint forces that ensures Joint access by leveraging the operational maneuver of sovereign, distributed, and networked forces operating globally from the sea. (MCRP 5-12C)

Self-Sufficient MAGTF: MAGTF capable of deploying, to any location on the globe, from the sea; operating across the range of military operations in a Joint environment; and capable of producing in place the necessary energy and water required for command, control, and sustainment. The MAGTF only requires liquid fuel for mobility systems, which are more energy efficient than current systems. (*USMC Expeditionary Energy Strategy*, February 2011)

Supportability: A key component of system availability. It includes design, technical support data, and maintenance procedures to facilitate detection, isolation, and timely repair and/or replacement of system anomalies. This includes factors such as diagnostics, prognostics, real-time maintenance data collection, and human systems integration considerations. (CJCSI 3170.01G)

Supporting Establishment: Personnel, bases, and activities that support USMC operating forces. (MCDP 1-0)

Sustainment: The provision of personnel, training, logistic, environment, safety and occupational health management, and other support required to maintain and prolong operations or combat until successful accomplishment or revision of the mission or of the national objective. (CJCSI 3170.01G)

System: A functionally, physically, and/or behaviorally related group of regularly interacting or interdependent elements; that group of elements forming a unified whole.(JP)

System of Systems (SoS): A set or arrangement of systems that results when independent and useful systems are integrated into a larger system that delivers unique capabilities. (CJCSI 3170.01G)

Systems View: An architecture view that identifies the kinds of systems, how to organize them, and the integration needed to achieve the desired operational capability. It also characterizes available technology and systems functionality. (CJCSI 3170.01G)

Task: An action or activity (derived from an analysis of the mission and CONOPS) assigned to an individual or organization to provide a capability. (CJCSI 3170.01G)

Weapon(s)System: A combination of one or more weapons with all related equipment, materials, services, personnel, and means of delivery and deployment (if applicable) required for self-sufficiency. (JP)

Energy Terms

Alternative Energy: Energy derived from non-fossil fuel sources. (*IPPC Third Assessment Report: Climate Change 2001: Working Group III, Mitigation*, Appendix II, Glossary) Alternative energy sources can include wind, solar, geothermal, wave energy, tidal currents, nuclear energy, agricultural residues, bio fuels, and algae.

Alternative Fuel: A fuel for vehicles that is not petroleum based or that has a significantly lowered petroleum content. The Energy Policy Act of 2005 defined alternative fuels as methanol, denatured ethanol, and other alcohols; mixtures containing 85 percent or more (or such other percentage, but not less than 70 percent, as determined by the Secretary of Energy, by rule, to provide for requirements relating to cold start, safety, or vehicle functions) by volume of methanol, denatured ethanol, and other alcohols with gasoline or other fuels; natural gas; liquefied petroleum gas; hydrogen; coal-derived liquid fuels; fuels (other than alcohol) derived from biological materials; electricity (including electricity from solar energy); and any other fuel the Secretary of Energy determines, by rule, is substantially not petroleum and would yield substantial energy security benefits and substantial environmental benefits. Biodiesel has been defined by the Energy Conservation and Reauthorization Act of 1998 as an alternative fuel.

Alternative Fuel Vehicle: In general, a dedicated vehicle or a dual-fueled vehicle. A dedicated vehicle is an automobile or motor vehicle that operates solely on alternative fuel. Duel-fueled vehicles are those that can operate on an alternative fuel and a conventional petroleum fuel. The term alternative fueled vehicle also includes (1) “a new qualified fuel cell motor vehicle” (as defined in Section 30B(b)(3) of the Internal Revenue Code of 1986), (2) “a new advanced lean burn technology motor vehicle” (as defined in Section 30B(c)(3) of that Code), (3) “a new qualified hybrid motor vehicle” (as defined in Section 30B(d)(3) of that Code); and (4) “any other type of vehicle that the Administrator demonstrates to the Secretary would achieve a significant reduction in petroleum consumption.” (NDAA 2008 and Energy Policy Act 1992)

Carbon Footprint: The total set of greenhouse gas (GHG) emissions caused directly and indirectly by an individual, organization, event, or product UK Carbon Trust, 2008, *Carbon Footprinting*. GHGs are measured in terms of their carbon dioxide (CO2) equivalent. For the U.S. Navy, the carbon footprint is currently defined as the total amount of CO2 equivalent released from direct energy consumption (fuels and electric) of the enterprise, including power generation, transportation (fleet and ashore), and heating.

Emissions Reduction: Lowered releases of GHG, volatile organic compounds, soot, particulate matter, nitrous oxide (NOx), SOx, and other substances associated with power generation, energy use, transportation, and industrial processes.

Energy Efficiency: Ratio of the work output of a system relative to the amount of energy required to deliver that amount of work.

Energy Efficiency Key Performance Parameter: Include fuel efficiency considerations in systems consistent with future force plans and approved planning scenarios. Include operational fuel demand and related fuel logistics resupply risk considerations with a focus on mission success and mitigation of the size of the fuel logistics force within the given planning scenarios. These assessments will inform the setting of targets and thresholds for the fuel efficiency of materiel solutions. Consider fuel risk in irregular warfare scenarios, operations in austere or concealed settings, and other asymmetric environments, as well as conventional campaigns. (JCIDS Manual, 31 July 2009)

Energy Independence: Achieving a level of technical or operational proficiency where energy requirements are no longer a significant recurring requirement that adversaries can exploit. This does not eliminate the need for considering energy, but it represents a strong basis for reliable sources of supply with a distributed operational structure for redundancy and security purposes. Energy independence also means to remove, but not eliminate, a significant portion of energy volatility exposure.

Energy Intensity: Energy consumption per square foot of building space, including industrial or laboratory facilities.

Energy Management: Identifying, developing, and safeguarding energy as a strategic resource and creating the tools, infrastructure, plans, policy, and operational practices that ensure energy becomes an operational advantage for the USMC.

Energy Market Volatility: The unpredictability of energy prices over time.

Energy Security: Having ensured access to reliable supplies of energy and the ability to protect and deliver sufficient energy to meet operational needs. (*Quadrennial Defense Review Report, 2010*)

Environmental Stewardship: A behavior demonstrated through continuous improvement of environmental performance; a commitment to efficient use of natural resources, protection of ecosystems, and, where applicable, a baseline of compliance with environmental

requirements. (*Everyday Choices: Opportunities for Environmental Stewardship*, report to Stephen L. Johnson, Administrator, U.S. Environmental Protection Agency, EPA Innovation Action Council, November 2005; *Dictionary of Military and Associated Terms*, U.S. Department of Defense 2005.)

Fossil Fuels: All hydrocarbon energy sources typically derived from anaerobically decomposed organisms. Fossil fuels include coal, natural gas, and crude oil.

Fully Burdened Cost of Fuel (FBCF): The commodity price for fuel plus the total cost of all personnel and assets required to move and, when necessary, protect the fuel from the point at which the fuel is received from the commercial supplier to the point of use. (NDAA 2009)

Gasoline Gallon Equivalent: A common method of measurement. Using fuel energy equivalents provides the user with a comparison tool for gauging various fuels against a known constant that has relative meaning. The gasoline gallon equivalent of an alternative fuel is that volume of fuel needed to provide 114,000 British thermal units (BTU), which is the normal energy content of a gallon of gasoline.

General Services Administration (GSA): The primary provider of workspace, security, furniture, equipment, supplies, tools, computers, and telephones for federal civilian agencies. GSA also provides travel and transportation services and manages a large part of the federal motor vehicle fleet. GSA is a mandatory supply source for USMC non-tactical vehicles.

Geothermal Energy: Energy generated using the temperature differential between the relatively cool surface of the Earth and elevated temperatures at depth or from known underground heat sources.

Greenhouse Gases (GHG): CO_2, methane (NH_4), NO_X, hydrofluourcarbons (HFC), perfluourocarbons (PFC), and sulfur hexafluoride (SF_6). (EO 13423)

Key Performance Parameters (KPP): Those attributes or characteristics of a system that are considered critical or essential to the development of an effective military capability and that make a significant contribution to the characteristics of the future Joint force as defined in the *Capstone Concept for Joint Operations*. KPPs must be testable to enable feedback from test and evaluation efforts to the requirements process. KPPs are validated by the Joint Requirement Oversight Council (JROC) for JROC Interest documents; by the JCB for JCB Interest documents;

and by the DoD component for Joint integration, Joint information, or independent documents. Capability development document (CDD) and capability production document (CPD) KPPs are included verbatim in the acquisition program baseline.

Metropolitan Statistical Area: The U.S. Office of Management and Budget (OMB) defines metropolitan statistical areas according to published standards that are applied to U.S. Census Bureau data. The general concept of a metropolitan statistical area is that of a core area containing a substantial population nucleus, together with adjacent communities having a high degree of economic and social integration with that core.

Net-Zero Installation: An installation that, over the course of a fiscal year, matches or exceeds the total electrical energy it consumes, in million BTUs, with energy generated from non-fossil fuel sources ("alternative energy").

Non-Tactical Vehicles: Vehicles that are available commercially and are owned, leased, or otherwise controlled passenger vehicles, cargo vehicles, material handling equipment, engineer equipment, and railway rolling stock.

Operational Energy: The energy required for training, moving, and sustaining military forces and weapons platforms for military operations. Includes energy used by tactical power systems, generators, and weapons platforms. (NDAA 2009)

Photovoltaic Energy: Solar energy generated using devices that directly convert solar energy into electricity using solid state (typically silicon-based) devices.

Reliable Energy: Refers to both supply and source of energy (i.e., company/country). Reliable energy supply is energy that can be developed, transported, and stored (logistics tail) for use as required. Reliable energy source is energy (fuel/electricity) that can be accessed for use as required.

Renewable Energy: Refers to energy derived from sources that are replenished by a continually occurring process. Energy produced by solar, wind, biomass, landfill gas, ocean (including tidal, wave, current, and thermal), hydrokinetic, geothermal, municipal solid waste, or new hydroelectric generation capacity achieved from increased efficiency or additions of new capacity at an existing hydroelectric project. (EO 13423)

Selectively Applied KPPs: The JROC has defined two KPPs to be selectively applied to programs: system training and energy efficiency. The sponsor will perform an analysis on the use of these parameters as KPPs. If the analysis determines that they should not be KPPs, a summary of the justification will be provided in the CDD. (JCIDS Manual, 31 July 2009)

Shore: The support structure, facilities, and all other involved ancillary structures that support the U.S. Navy missions that do not fall into the tactical theater or forward deployments.

Solar Energy: Energy derived from the incoming solar radiation that affects the earth's surface. This can include both solar photovoltaic energy and solar thermal energy using concentrating mirrors or lenses.

Sustainability, Sustainable: To create and maintain conditions under which humans and nature can exist in productive harmony and that permit fulfilling the social, economic, and other requirements of present and future generations. (EO 13541)

Tactical Vehicles: A vehicle with military characteristics resulting primarily from military research and development processes and designed primarily for use by forces in the field in direct connection with or in support of combat or tactical operations. Commercial vehicles and modified commercial vehicles are also considered tactical vehicles if they are subject to use in combat operations or support combat operations.

Wind Energy: Energy derived from the natural circulation of atmospheric air across the globe, typically captured using multi-blade wind turbines that use airfoil lift to translate airflow into rotational torque. Other concepts, such as vertical axis wind turbines with both cup and airfoil-based designs that may reduce space requirements for compact installations, have been developed.

USMC Definition References

Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3170.01G: Establishes the policies for the Joint Capabilities Integration and Development System (JCIDS)

Joint Publication (JP) 1-02: *Department of Defense Dictionary of Military and Associated Terms*

Marine Corps Reference Publication (MCRP) 5-12C: *Marine Corps Supplement to the Department of Defense Dictionary of Military and Associated Terms*

National Defense Strategy of the United States (NDS): Washington, DC: Department of Defense, 1 March 2005

Navy Tactical Reference Publication (NTRP) 1-02: *Navy Supplement to the Department of Defense Dictionary of Military and Associated Terms*, Washington, DC: U.S. Navy, August 2006

Total Force Structure Process (TFSP): MCO 5311.1D, 26 February 2009

References

Executive Orders

Executive Order (EO) 13149, *Greening the Government Through Federal Fleet and Transportation Efficiency*, 21 April 2000 (superseded by EO 13423)

EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, 24 January 2007

EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, 5 October 2009

White House

The White House, *U.S. National Security Strategy 2010*, May 2010

Legislation

Energy Policy Act of 1992, Title III (Public Law [PL] 105-388)

Energy Conservation and Reauthorization Act of 1998, Section 7 (PL 105-388)

National Defense Authorization Act for Fiscal Year 2002, Section 318 (PL 107-107)

Energy Policy Act of 2005, Title VII (PL 109-58)

Energy Independence and Security Act of 2007 (PL 110-140)

Department of Defense Authorization Act for Fiscal Year 2008, Section 2862 (H.R.4986)

National Defense Authorization Act for Fiscal Year 2007

National Defense Authorization Act for Fiscal Year 2009

National Defense Authorization Act for Fiscal Year 2010

Department of Defense

Policy and Instructions

Department of Defense Instruction (DoDI) 4170.11, *Installation Energy Management*, 22 November 2005

DoDI 5000.02, *Operation of the Defense Acquisition System*, 8 December 2008

Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics (OUSD/AT&L) Memorandum, *Required Use of Fuels in Flex Fuel Vehicles*, 27 December 2007

Program Budget Decision 735, *Bulk Petroleum Management*, 5 December 1991

Select Reports and Background

Quadrennial Defense Review Report 2010, Office of the Secretary of Defense, February 2010

Report of the Defense Science Board Task Force on DoD Energy Strategy: More Fight—Less Fuel, OUSD/AT&L, February 2008

More Capable Warfighting Through Reduced Fuel Burden, Defense Science Board Task Force on Improving Fuel Efficiency of Weapons Platforms, OUSD/AT&L, January 2001

Joint Staff Rapid Validation and Resourcing Request, Renewable Energy System, Commanding General, Multi-National Force—West (MNFW), 25 July 2006

Fact Book 2008, Defense Energy Support Center (DESC), 2008

Department of Defense Report to Congress on Energy Security Initiatives, DoD Energy Security Task Force, OUSD(AT&L), October 2008

DoD Mobile Electric Power Systems Command Brief to EGSA, Paul Richard, DoD Project Manager Mobile Electric Power (PM MEP), March 2009

EGSA Government Relations Session: Army R&D Efforts, C. Bolton, DoD PM MEP, EGSA fall meeting, 14 September 2009

Chairman of the Joint Chiefs of Staff Instructions

Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3170.01G, *Joint Capabilities Integration and Development System*, 1 March 2009

Manual for the Operation of the *Joint Capabilities Integration and Development System*, Joint Staff, 31 July 2009

Department of the Navy

Policy and Instructions

2007 Department of the Navy Alternative Fuel Vehicle Strategy (AFV), Assistant Secretary of the Navy for Installations and Environment (ASN (I&E)) Memorandum, 7 November 2007

Biodiesel Fuel Use in Diesel Engines, Department of the Navy Environmental Policy Memorandum 05-01, 18 January 2005

Energy Conservation, ASN (I&E) Memorandum, 14 November 2005

Future Fuels, ASN for Research, Development and Acquisition, Naval Research Advisory Committee, April 2006

Naval Operations Concept 2010, Implementing the Maritime Strategy, Chief of Naval Operations and Commandant of the Marine Corps and Commandant of the Coast Guard Department, May 2010

Naval S&T Strategic Plan, Defining the Strategic Direction of Tomorrow, Office of Naval Research Science & Technology, 2009

Secretary of the Navy's Energy Directives for Chief of Naval Operations and Commandant of Marine Corps (DRAFT), October 2010

The Department of the Navy's Energy Program for Security and Independence, Secretary of the Navy, 1 October 2010

Select Reports and Background

Power and Energy Overview Brief to MajGen Robert E. Shmidle, Paul Gido and Richard Carlin, Office of Naval Research, 30 April 2008

S&T in Support of USMC Naval Energy Futures, George Solhan, Office of Naval Research, presented at the USMC Energy Summit 2009, 13 August 2009

Solid Oxide Fuel Cell Based Tactical Electrical Power Demonstration, Office of Naval Research, ONR BAA Announcement Number 09-034, 22 July 2009

United States Marine Corps

Policy and Guidance

U.S. Marine Corps, 35th Commandant of the Marine Corps, *Commandant's Planning Guidance 2010*

U.S. Marine Corps, *2009–2015 Marine Corps Service Campaign Plan*, 9 December 2009

U.S. Marine Corps, Assistant Commandant of the Marine Corps, Memorandum 11/09, *Establishment of the Marine Corps Expeditionary Energy Office*, 19 November 2009

U.S. Marine Corps, Commandant of the Marine Corps Policy Memorandum 2-02, *Increased Warfighting Capability Through Reduced Fossil Fuel Burden*, 15 August 2002

U.S. Marine Corps, *Concepts and Programs 2010*, 2010 Edition, published by Marine Corps Programs and Resources Department

U.S. Marine Corps, *Marine Corps Operating Concepts, Assuring Littoral Access…Winning Small Wars*, Third Edition, June 2010

U.S. Marine Corps, *U.S. Marine Corps S&T Strategic Plan, Leading Edge Technology for the Marines of Tomorrow*, July 2009

U.S. Marine Corps, *Ten by '10, Facilities Energy and Water Management Program Campaign Plan*, 2009

U.S. Marine Corps, *Vision and Strategy 2025*, December 2008

U.S. Marine Corps, *Vision and Strategy 2025, Implementation Planning Guidance*, December 2008

U.S. Marine Corps Order, 3900.15B, *Marine Corps Expeditionary Force Development System (EFDS)*, 10 March 2008

U.S. Marine Corps Order, 3900.17, *The Marine Corps Urgent Needs Process (UNP) and the Urgent Universal Need Statement (Urgent UNS)*, 17 October 2008

U.S. Marine Corps Order, 3960.6, C52, *Marine Corps Science and Technology*, 30 August 2002

U.S. Marine Corps Order, 5311.1D, *Total Force Structure Process (TFSP)*, 26 February 2009

Select Reports and Background

2010 Report to Congress on the Posture of the United States Marine Corps, General James T. Conway, Commandant of the U.S. Marine Corps, 24 February 2010

Analysis of Logistics Related Casualties for Marine Forces in Afghanistan, Current Operational Analysis Support team, Operations Analysis Division (AD), Marine Corps Combat Development and Integration Command, September 2010

Afghanistan Assessment Outbrief, Colonel T.C. Williams, Marine Energy Assessment Team (MEAT), 21 October 2009

Expeditionary Power Overview, Brief for CG MCWL, Marine Corps Warfighting Lab, CSS Branch, 7 August 2009

"Innovations in United States Marine Corps Expeditionary Power Systems," Michael A. Gallagher, Marine Corps Systems Command, *WSTIAC Quarterly*, Vol. 9, No.1, April 2009

Lightening the Load—Reducing the Footprint in the Expeditionary Environment—A National Security Imperative for Success, USMC Energy Summit, Washington, DC, 13 August 2009

USMC Energy Efficiency: Brief to LtGen Flynn, Marine Corps Warfighting Laboratory, 26 August 2009

USMC Operational Energy Efforts and Challenges, 9/11 to Now, Michael D. Boyd, presented at the USMC Energy Summit, Washington, DC, August 2009

Department of the Army

AutoDise 6.2.0 User's Manual, prepared for Army CECOM Power Generation Branch by BRTC Inc., 2009

Fabric Structure Team Overview: Shelter Technology, Engineering, Fabrication Directorate, Jean Hempel, U.S. Army Natick Soldier RD&E Center, November 2009

High Performance Aerogel Insulation for Shelters, Elizabeth Swisher, U.S. Army Natick Soldier RD&E Center, 13 January 2008

Hybrid-Intelligent Power "HI-POWER," CERDEC, U.S. Army RDECOM. Available at *http://www.nist.gov/eeel/high_megawatt/upload/Holcomb-2.pdf*

Improved Environmental Control Unit (IECU) Program Overview, Jeff Taylor, PM-MEP, presented at JOCATA Technical Working Group Meeting, November 2009. Available at *http://www.natick.army.mil/Soldier/jocotas/Nov09/taylorov.pdf*

Minimizing the Footprint of Deployed Bases: Army Approaches to Waste to Energy Conversion, Patrick Taylor, U.S. Army RDECOM, 7 May 2009

Net Zero Plus JCTD: Evaluation of Energy Savings Technologies for Expeditionary Shelters, U.S. Army Natick Soldier RD&E Center, JOCOTAS, 4 November 2009

Sustain the Mission Project: Casualty Factor for Fuel and Water Resupply Convoys, Army Environmental Policy Institute, September 2009

Spray Foam Insulation Information Brief, B. Frounfelker and T. Wilke, Army Material Systems Analysis Activity (AMSAA), presented to Army Senior Energy Council, 30 July 2009

Strategic Energy Resource Investment Optimization for the U.S. Army, Center for Army Analysis, August 2004

Shelter Technology Engineering and Fabrication Directorate: Technologies Overview, U.S. Army Natick Soldier RD&E Center, August 2009

Tactical Electric Power (TEP): Emerging Technologies and Initiatives That Influence Organizational Power Needs, *U.S. Army Combined Arms Support Center White Paper*, January 2009

Tactical Garbage to Energy Refinery, U.S. Army RDECOM, Edgewood Chemical Biological Center, ECBC-TR-713, October 2009

U.S. Army Rapid Equipping Force (REF) briefing, July 2007

Other Government/Industry

A Citizen's Guide to National Oil Companies, Part A, Technical Report, World Bank Group and Center for Energy Economics/Bureau of Economic Geology Jackson School of Geosciences, University of Texas at Austin, October 2008

A Mobile Hybrid Power Source With Intelligent Control, Rick Silva, CME, Joint Service Power Expo, 7 May 2009. Available at *http://www.dtic.mil/ndia/ 2009power/2009power.html*

Annual Energy Outlook 2010: Early Release Overview, Energy Information Service, DOE/EIA-0383, 14 December 2009. Available at *http://www.eia.doe.gov/oiaf/aeo/overview.html*

Annual Energy Outlook 2009, Energy Information Service, DOE/EIA-0383. Available at *http://www.eia.doe.gov/oiaf/forecasting.html*

Airline Fuel Cost and Consumption, Bureau of Transportation Statistics, Research and Innovative Technology Administration. Available at *http://www.transtats.bts.gov/fuel.asp?pn=1*

Convoy Guards in Afghanistan Face and Inquiry, Dexter Filkins, The New York Times, 6 June 2010

Coolerado Cooler Helps to Save Cooling Energy and Dollars, U.S. Department of Energy, Federal Energy Management Program, Technology Installation Review, DOE/GO-102007-2325. Available at *www.eere.energy.gov/femp/pdfs/tir_ coolerado.pdf*

Country Energy Profiles, U.S. Energy Information Administration, U.S. Department of Energy. Available at *http://www.eia.doe.gov/country/index.cfm*

Cutting the Tether, Enhancing U.S. Military's Energy Performance, James Morin, Progressive Policy Institute, May 2010

"DoD's Energy Challenge as Strategic Opportunity," Amory B. Lovins, *Joint Force Quarterly*, 57:33-42 (2Q2010), National Defense University Press, Second Quarter 2010

Defense Management: DoD Needs to Increase Attention on Fuel Demand Management at Forward-Deployed Locations, U.S. Government Accountability Office (GAO), February 2009

Developments of Proof of Concept Units for the Advanced Medium-Sized Mobile Power Source (AMMPS) Program, Oak Ridge National Laboratory, ORNL/TM-2001/222, March 2002

Energy Security: America's Best Defense, Deloitte, LLC, December 2009

Fuel and Water for OEF: Towards Developing Fully Burdened Costs, E. Blankenship and R. Cole, Headquarters Marine Corp PA&E, presented at MORS Power and Energy Workshop, 30 November 2009

Department of Defense Energy Strategy Teaching an Old Dog New Tricks, Gregory J. Lengyel, Colonel, U.S. Air Force, 21st Century Defense Initiative, Foreign Policy Studies, The Brookings Institution, August 2007

"How the U.S. Army Protects its Trucks—by Paying the Taliban," *The Guardian*, 13 November 2009. Available at *http://www.guardian.co.uk/world/2009/nov/13/us-trucks-security-taliban*

Marine Corps Expeditionary Power and Energy Symposium, National Defense Industry Association (NDIA), various industry exhibit brochures, January 2010

Mobile Electric Power for Today and Tomorrow, Paul Richard, PM-MEP, presented Joint Service Power Expo, 25 April 2007. Available at *https://www.pm-mep.army.mil/pdffiles/Joint_Service_ Power_Expo_25Apr07.pdf*

National Security and the Threat of Climate Change, CNA Corporation, 2009

Reducing Operational Dependence on Fossil Fuel Capability Vision the Self Sustaining Forward Operating Base, Defence Technology and Innovation Centre, UK Ministry of Defence, 19 June 2009

Reducing Energy Footprint on the Battlefield, CNA Corporation, Michael Bowes and Barry Pifer, April 2010

Person Portable JP-8 Fueled Fuel Cell Power Generator PJF-Gen., Available at *www.virtualacquisitionshowcase.com/document/627/briefing*

Petroleum Statistics, U.S. Energy Information Administration, U.S. Department of Energy. Available at *http://www.eia.doe.gov/oil_gas/petroleum/info_glance/petroleum.html*

"Technology Timelines 2010: A Look Ahead for the Next 30 Years From an Assortment of Industry Leaders," *Professional Pilot*, pp 54–62. M. Cetron, President, Forecasting International, December 2009

"Trash Tactics in Iraq," *Biomass Magazine*, October 2008

Thermoelectric Developments for Vehicular Applications, U.S. Department of Energy, Diesel Engine-Efficiency and Emissions Research Conference, Detroit, 24 August 2006

World Energy Outlook 2009 Executive Summary, International Energy Agency. Available at *http://www.iea.org/weo/2009.asp*

"University of Delaware-Led Team Sets Solar Cell Record," *Science Daily*, 30 July 2007. Available at *www.sciencedaily.com/releases/2007/07/070726210931.htm*

"U.S. Indirectly Paying Warlords," Karen DeYoung, *The Washington Post*, 22 June 2010

Marine Corps Expeditionary Energy Strategy and Implementation Plan
produced by
the Marine Corps Expeditionary Energy Office
Headquarters, U.S. Marine Corps
Washington, DC 20380-1775