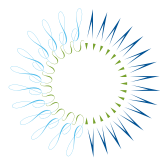


# Reenergizing America's Defense

How the Armed Forces Are Stepping Forward to Combat  
Climate Change and Improve the U.S. Energy Posture



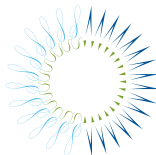
THE PEW PROJECT ON  
NATIONAL SECURITY, ENERGY AND CLIMATE

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# Reenergizing America's Defense

How the Armed Forces Are Stepping Forward to Combat  
Climate Change and Improve the U.S. Energy Posture



THE PEW PROJECT ON  
**NATIONAL SECURITY, ENERGY AND CLIMATE**

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The Pew Project on National Security, Energy and Climate, an initiative of the Trusts, is dedicated to highlighting the critical linkages between national security, energy security, the economy and climate change. This project brings together scientists and military experts to examine new strategies for responding to consequences of climate change and potential impacts on our national security, increasing our energy independence and preserving our nation's natural resources.

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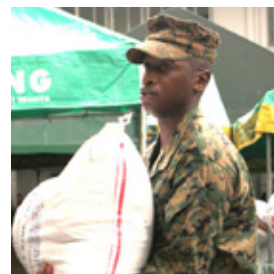
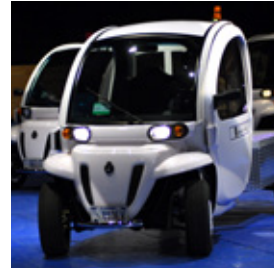
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# TABLE OF CONTENTS

<b>A Word for the American Public</b> .....	<b>ii</b>
<b>Executive Summary</b> .....	<b>4</b>
<b>Introduction</b> .....	<b>6</b>
<b>DoD Energy Burden</b> .....	<b>7</b>
<b>Leading by Example</b> .....	<b>10</b>
Defense Strategy Planning .....	<b>10</b>
New Energy Management and Leadership Initiatives .....	<b>10</b>
<b>Armed Services Climate and Energy Initiatives</b> .....	<b>12</b>
U.S. Army Initiatives .....	<b>12</b>
U.S. Navy Initiatives.....	<b>14</b>
U.S. Air Force Initiatives .....	<b>16</b>
U.S. Marine Corps Initiatives .....	<b>18</b>
<b>Conclusion</b> .....	<b>20</b>
<b>Endnotes</b> .....	<b>21</b>





## A WORD FOR THE AMERICAN PUBLIC

**By Senator John W. Warner, Retired**

In the fall of 2009, The Pew Charitable Trusts, CNA and the Military Officers Association of America sponsored a forum to discuss the considerable progress being made by our military to meet the intertwined challenges of climate change, energy security, economic stability and national security. Presentations by the U.S. Department of Defense and the U.S. Army, Navy, Air Force and Marine Corps detailed the impressive initiatives and innovations currently under way. They reflected the ingenuity and vigor with which the men and women of our armed forces, as well as their civilian partners in DoD, are addressing these interrelated challenges.

In 2008, Congress required DoD for the first time to consider the potential effects of climate change on future military missions. The 2008 National Defense Authorization Act specifically required the department:

“(A) to assess the risks of projected climate change to current and future missions of the armed forces;

“(B) to update defense plans based on these assessments, including working with allies and partners to incorporate climate mitigation strategies, capacity building, and relevant research and development; and

“(C) to develop the capabilities needed to reduce future impacts.”<sup>1</sup>

As a former chairman of the U.S. Senate Armed Services Committee, I worked on these issues and was privileged to join Sen. Hillary Clinton, the principal sponsor, in co-sponsoring the foregoing legislation.

The military embraced the requirement. In fact, the congressional mandate of 2008 was met on Feb. 1, 2010, in the DoD's release of the *Quadrennial Defense Review Report*, which addresses the serious national security challenges presented by climate change and our current energy posture. The report states, “While climate change alone does not cause conflict, it may act as an accelerant of instability or conflict, placing a burden to respond on civilian institutions and militaries around the world.” Further, the report recommends that DoD continue to respond to this challenge. The Defense Department, the report says, “is increasing its use of renewable energy supplies and reducing energy demand to improve operational effectiveness, reduce greenhouse gas emissions in support of U.S. climate change initiatives, and protect the Department from energy price fluctuations.”

History records the many missions in which the U.S. military has responded abroad to provide humanitarian relief or stability of a nation's electoral process, or to help a nation maintain its sovereignty. For instance, the U.S. military, along with others, responded to the Indonesian tsunami in 2004; and more recently, we witnessed heroic efforts by the United States and other nations to support Haiti after its devastating earthquake.

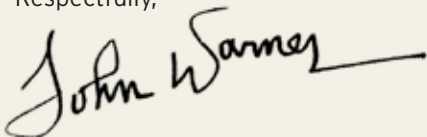
In 1993, just after the tragic loss of our troops in the incident known as "Blackhawk Down," I, along with other senators, went to Somalia, where we witnessed firsthand how shortages of food, energy and water, as well as other natural resources, contributed to disastrous rioting, upheaval and political instability. Similarly, in the summer of 2003, I was asked by the Supreme Allied Commander of NATO to proceed to Liberia as U.S. ships were positioning offshore and sending contingents of troops in to help stabilize the situation amid violent rioting and give added protection to our embassy. The very presence of U.S. warships, clearly visible to rioters along the shoreline, contributed to the success of our military mission. I witnessed the excellent professionalism of our troops using measured force and providing support to diplomatic efforts. Among the root causes of this strife were shortages of basic, universal human necessities.

Energy dependence and climate change are clearly emerging as added challenges—complicating and expanding potential missions for our military. Yet, the *Quadrennial Defense Review Report*, prepared by uniformed and civilian personnel acting under the guidance of Defense Secretary Robert Gates, Undersecretary Michèle Flournoy and Assistant Secretary Kathleen Hicks, demonstrates that once again, our armed forces are preparing to lead in addressing existing and emerging national security challenges.

As Congress deliberates its role, DoD is moving ahead steadily on a broad range of energy and climate initiatives. The report that follows, *Reenergizing America's Defense*, details many of DoD's initiatives and accomplishments and its clear leadership and strategic approach to climate change and our energy posture. The report, published by The Pew Charitable Trusts, documents how the armed forces are working for a more secure energy future and preparing for the potential impacts of climate change in order to best protect our home front and join other nations in achieving our common goals.

I, along with The Pew Charitable Trusts, recognize the other organizations and many individuals who collaborated in the research and preparation of this report. Pew and others across our nation are continuing to provide the public with objective analyses and perspective on the important linkages among climate change, energy security, economic stability and our national security.

Respectfully,

A handwritten signature in black ink that reads "John Warner". The signature is written in a cursive style with a long horizontal line extending to the right.

# EXECUTIVE SUMMARY

Energy and the way we use it are far-reaching national security issues.

The U.S. economy's need for oil, particularly in the transportation sector, is a driving force in geopolitics and thus in the posture and deployment of the U.S. military. Oil, like other fossil fuels, is also an environmental security issue. Defense and intelligence experts are finding that long-term climate change has the potential to foster social instability and political conflict as weather patterns change, seas rise, droughts occur and people migrate. And finally, energy—especially liquid fuels—is a key consideration and critical risk in military deployments abroad.

Energy, the environment, the economy and security are inextricably linked. That is why the Department of Defense and the military services are stepping forward not only to understand these challenges, but also to demonstrate leadership in responding to them.

This report provides a brief overview of the rationale and direction of DoD efforts on an important new mission as leaders, innovators and adopters of advanced energy strategies and technologies.

As the largest government user of energy, the department has a keen appreciation of the ways energy innovation can enhance operational effectiveness, bolster national

competitiveness and increase energy security, all while saving lives and money and reducing the U.S. carbon boot print.

Defense Secretary Robert M. Gates has identified energy as one of the department's top 25 "transformational priorities." In 2009, the Office of the Director for Operational Energy Plans and Programs was established to provide leadership and oversee planning of the U.S. armed forces as they relate to energy. And in 2010, the department released its Quadrennial Defense Review, declaring that climate change "will shape the operating environment, roles, and missions" the department undertakes, and that "DoD will need to adjust to the impacts of climate change on our facilities and military capabilities."

Under the auspices of the department, the armed forces are forging ahead on initiatives to change their energy posture. Each of the four branches has long-term goals to increase energy efficiency and reduce carbon emissions.

DoD has historically been a national leader in technological innovation, creating such transformational tools as the Internet and the Global Positioning System. Building on this history, DoD can be a leader in creating alternative fuels, advanced energy storage and more efficient vehicles on land, in the air and at sea.

The Pew Charitable Trusts initiated this report to catalog current DoD efforts

to develop and deploy clean energy technologies and to reduce carbon emissions. Our examination finds that the U.S. military is clearly working to address the twin threats of energy dependence and climate change.

DoD leaders can help reduce the risks that energy patterns pose for the nation

and its troops. But more must be done to mirror the ingenuity and foresight of the military. A strong policy framework that puts a price on carbon, invests in energy innovation and helps deploy low-cost, low-carbon energy sources will strengthen the economic, environmental and national security of our nation.

Tech. Sgt. Cohen A. Young, U.S. Air Force



Members of the U.S. military and their leaders, whether at the USS Arizona Memorial in Hawaii, left, or in the Pentagon, are keenly aware of how energy innovation can enhance the mission.

# INTRODUCTION

Climate change, national security and energy dependence are interrelated global challenges. U.S. dependence on foreign sources of energy constitutes a serious threat—militarily, diplomatically and economically. And climate change is expected to act as a “threat multiplier,”<sup>2</sup> stoking instability in some of the most volatile regions of the world and, in turn, threatening America’s security.

Defense and intelligence experts have found that climate change can worsen instability as water and food supplies dwindle, storm intensity increases, agricultural patterns are disrupted and human migration across borders increases because of conflict or resource shortages.

Such effects also could increase U.S. military missions as troops are called on for support domestically and internationally. At home, the armed forces could be needed to support civil authorities, as they did during Hurricanes Andrew and Katrina. Abroad, the military’s capabilities could be required in a range of humanitarian and security missions, from responding to natural disasters to assisting nations stressed by hunger and drought.

The U.S. military has a broad mission, including managing ambiguous or incomplete pieces of information, anticipating threats and, not least, keeping Americans safe. The military and the intelligence community monitor and analyze information and factors that can destabilize foreign states or may require humanitarian assistance. It is in this context that defense specialists and the military are addressing climate change and the U.S. “energy posture,” an umbrella term that encapsulates how DoD approaches its energy use, consumption, costs and sources and how these patterns, in turn, affect the readiness of the armed forces.

This report provides a brief overview of the important initiatives DoD has undertaken to lead in energy strategies and technologies. From operational effectiveness and energy conservation initiatives to renewable energy investments and digital grid research, the military is working to better understand the nature of these challenges and to find solutions that will help protect the United States and ensure prosperity, leading the way toward a cleaner, more secure energy future.

“Energy, security, economics, climate change—these things are connected. ... It’s a system of systems. It’s very complex.”

—retired Gen. Gordon R. Sullivan, former Army chief of staff and chairman, CNA Military Advisory Board, which wrote *National Security and the Threat of Climate Change and Powering America’s Defense: Energy and the Risks to National Security*

# DOD ENERGY BURDEN

National security leaders, the defense community and academia increasingly recognize that energy poses strategic, operational and fiscal challenges to the military.

The enormous amount of fuel needed for transportation highlights the energy challenges DoD confronts. These challenges begin with the department's responsibility to protect vessels carrying oil and to ensure stable oil supplies in critical crossroads, which brings the military into sometimes volatile and dangerous areas, such as the Strait of Hormuz and the Somali coast. But the burden does not end there.

Operationally, modern deployments create heavy logistical requirements such as fuel convoys—the “long tail,” in military parlance—that impose costs, burdens and risks to operational

effectiveness and the safety of military personnel. The troop risks associated with fuel requirements have been tragically evident with the improvised explosive devices terrorists use to attack U.S. convoys in Iraq and Afghanistan.<sup>3</sup> Manning, equipping and defending this “long tail” siphons money, combat power and still more energy. Worse yet, it puts our troops at risk.

The department's reliance on fossil fuels compromises combat effectiveness by restricting mobility, flexibility and endurance on the battlefield. Fuel logistics have inhibited the progress of U.S. forces driving into Iraq,<sup>4</sup> and such limitations continue to impede operations in Iraq and Afghanistan. In a single month of combat, June 2008, 44 vehicles and 220,000 gallons of fuel were lost in attacks or other events, DoD officials found.<sup>5</sup>

Supplying the battlefield with fuel, as this U.S. Army convoy is doing in northern Iraq, poses burdens and risks to military operations and personnel.



Lance Cpl. Kelly R. Chase, U.S. Marine Corps

“Our dependence on foreign oil reduces our international leverage, places our troops in dangerous global regions, funds nations and individuals who wish us harm, and weakens our economy.”

—*Powering America's Defense: Energy and the Risks to National Security*,  
CNA's Military Advisory Board report

The military's dependence on fossil fuels also has significant financial and budgetary implications. Unexpectedly high oil prices and overreliance on petroleum fuels threaten to divert funds from military operations and procurement, compounding the difficult choices in defense budgeting. For example, every \$10 change in the per-barrel price of oil means more than \$1.3 billion in additional DoD energy costs on average.<sup>6</sup> When oil prices shot up in 2007 and 2008, it strained the financial resources of the military and the nation's economic security.<sup>7</sup>

Domestically, DoD is responsible for thousands of buildings and structures—offices, installations, housing and the like—and 160,000 non-tactical vehicles.<sup>8</sup> Each of these assets consumes energy, adds to the military's fuel bill and contributes to the nation's carbon pollution that causes global warming.

In addition to their energy supply needs, military installations depend on the aging and vulnerable U.S. transmission grid that allows the transfer of electrical energy. When the grid fails, the military is

The Department of Defense is responsible for thousands of buildings and structures, including Fort Benning, right, contributing to the more than 3.8 billion kilowatt-hours of electricity used by military buildings on average per year.



U.S. Army.

affected in two ways. First, bases can lose power. Second, troops can be called on in disasters to provide contingency support for civilian relief efforts, a task further complicated by base power shortages.

DoD accounts for nearly 80 percent of the U.S. government's total energy consumption<sup>9</sup>—75 percent of which is liquid fuels that power aircraft, ships, combat vehicles and forward-deployed generators,<sup>10</sup> thereby consuming more than 300,000 barrels of oil a day.<sup>11</sup> The other 25 percent of DoD's total energy consumption is in the form of electricity to run facilities and bases. The department operates almost 600,000 buildings, which use more than 3.8 billion kilowatt-hours of electricity on average per year.<sup>12</sup>

In 2008, DoD's energy budget officially was \$20 billion,<sup>13</sup> but many experts recognize this as only a fraction of the military's true energy costs. Internal DoD

research has documented much larger costs associated with the “fully burdened cost of fuel”—the cost of the people and operations required to deliver the fuels that are used to fly the jets, power the tanks and run the expeditionary bases.<sup>14</sup> For example, about 70 percent of the tonnage the Army delivers to a battlefield is fuel- and water-related.<sup>15</sup> In Iraq, the Marines have found that 90 percent of fuel is used for combat support, and only 10 percent is used for operations.<sup>16</sup> Estimates of the fully burdened costs of fuel, depending on when and where it is needed, range from two to 20 times the pump price for aerial refueling, to hundreds of dollars a gallon when delivered to a forward area.<sup>17</sup> In that scenario, some estimates run as high as \$400 a gallon.<sup>18</sup>

“The Department is increasing its use of renewable energy supplies and reducing energy demand to improve operational effectiveness, reduce greenhouse gas emissions in support of U.S. climate change initiatives, and protect the Department from energy price fluctuations.”

—DoD's 2010 Quadrennial Defense Review Report

# LEADING BY EXAMPLE

The U.S. military has a long history in innovation. And it has a significant stake in helping to ensure that the United States continues to lead and excel in transforming its energy posture, reducing the effects of climate change and winning the worldwide competition in clean energy technology. The department has developed a keen appreciation of the ways energy innovation can enhance operational effectiveness, bolster national competitiveness and increase energy security, all while saving lives and money and reducing America's carbon boot print.

## Defense Strategy Planning

The *Quadrennial Defense Review Report* (QDR) is a comprehensive assessment of the international security environment in which DoD operates. It explores new ideas for addressing long-standing and emerging threats to U.S. security. The understandings, assumptions, findings and ideas in the QDR form the key foundation for America's national defense strategy.

Released on Feb. 1, 2010, the QDR provides for the first time a clear assessment of the climate effects on national security. It declares, "Climate change ... may act as an accelerant of instability or conflict, placing a burden to respond on civilian institutions and militaries around the world."<sup>19</sup>

## New Energy Management And Leadership Initiatives

Historically, DoD has been a leader in the Federal Energy Management Program, a Department of Energy effort to improve the government's energy practices. It is on track to achieve federal goals of reducing facility energy intensity—the energy used per unit of activity—3 percent annually below 2003 levels by 2015.<sup>20</sup> More recently, in response to concerns over spikes in fuel prices and fuel-supply issues in Iraq, Secretary Gates has identified energy as one of the department's top 25 "transformational priorities."<sup>21</sup>

The department is emphasizing energy security initiatives to address fuel

"The payoff to DoD from reduced fuel demand in terms of mission effectiveness and human lives is probably greater than for any other energy user in the world."

—*More Fight—Less Fuel*, a report of the Defense Science Board Task Force on DoD Energy Strategy

“The QDR may be the most important report DoD provides Congress. It really requires the department to step back and think strategically about the present and the future.”

—Michèle Flournoy, undersecretary of defense for policy

issues related to operational systems and energy use by installations. In 2006, DoD established a Defense Energy Security Task Force with the aim of reducing fuel intensity and increasing combat capability.<sup>22</sup> In 2009, the task force became the Office of the Director of Operational Energy Plans and Programs. The statute creating the office empowers the director to oversee operational energy plans and programs, establish and implement an energy strategy, coordinate all the branches’ energy plans and research-and-development investments related to operational energy demand and supply technologies.

The director, awaiting confirmation as this report was written, will work to enhance interservice collaboration on energy innovation, building on department-wide programs that have

begun to share information and objectives. For example, there are interagency and tri-service working groups, coordinated through the Defense Energy Support Center, to share information and harmonize alternative fuels activities.<sup>23</sup>

DoD is working with the Defense Advanced Research Projects Agency (DARPA) and other agencies to stay at the forefront of integrating emerging energy technologies. For example, DARPA is advancing research, development and demonstration of energy supply- and demand-side technologies that could be deployed across defense weapons platforms and vehicles. The American Recovery and Reinvestment Act of 2009 included \$300 million to support DoD clean energy innovations in generation, transmission, end use and storage.<sup>24</sup>

# ARMED SERVICES CLIMATE AND ENERGY INITIATIVES

“We have the great opportunity together to be early adopters of new energy technologies that will improve our security and will one day have a broader utility to the nation.”

—Adm. Gary Roughead, chief of naval operations

Within DoD, the Army, Navy, Air Force and Marine Corps are taking up the challenge of saving energy, mitigating climate change and reducing costs. Each service has initiated programs and is developing additional plans to increase efficiency and productivity, and to decrease costs and carbon emissions.

## U.S. Army Initiatives

Every year, the Army uses about 880 million gallons of fuel and consumes 9.1 million megawatt-hours of electricity.<sup>25</sup> Unlike the Air Force and Navy, for which transportation fuels represent the majority of energy consumed, permanent bases are the Army’s largest source of energy consumption. When forces are deployed, however, the proportion shifts toward higher consumption by field generators and transportation fuels for combat and tactical vehicles.<sup>26</sup>

In recent years, the Army has begun to address energy and related environmental considerations more effectively. In 2008, the service established a Senior Energy Council to provide sustained, high-level leadership to Army energy policy,

programs and funding. In January 2009, the council approved the Army Energy Security Implementation Strategy (AESIS). It sets five key goals:

- Reduce energy consumption.
- Increase energy efficiency across platforms and facilities.
- Increase use of renewable and alternative-energy sources.
- Ensure access to sufficient energy supplies.
- Reduce adverse environmental impacts.<sup>27</sup>

The Army accounts for 36 percent of total DoD facility energy use,<sup>28</sup> and thus it has prioritized saving energy on its bases and facilities, recognizing that wasting energy diverts funds that could be applied to enhancing combat power and caring for military families. Installations hold significant opportunities for energy efficiency and renewable energy as a means of cutting costs, emissions and risks associated with reliance on traditional energy sources. The Army

“Given the Army’s reliance on energy, disruption of critical power and fuel supplies would harm the Army’s ability to accomplish its missions. Such a risk exposes an Army vulnerability that must be addressed by a more secure energy position and outlook.”

–2009 Army Energy Security Implementation Strategy

is exploring the use of energy-saving performance contracts, whereby energy-efficiency improvements are undertaken at no upfront cost.<sup>29</sup> In addition, the Army is using advanced efficiency standards and controls in building design and construction.

Projects under way at Army facilities include:

- A 500-megawatt solar power generation plant at Fort Irwin, Calif., that will help power the base and reduce the facility’s vulnerability to

power disruptions. The Army has named Fort Irwin a “net-zero plus” installation and hopes to end the base’s reliance on the public electric grid within a decade.<sup>30</sup>

- A transition to the use of 4,000 electric vehicles during the next three years—giving the Army one of the world’s largest electric fleets. This will help avoid emitting more than 100,000 tons of carbon dioxide and cut the use of liquid fossil fuels by more than 11 million gallons.<sup>31</sup>



C. Todd Lopez, U.S. Army

Among the Army’s energy-efficiency initiatives is a transition to 4,000 electric vehicles in the next three years.

“Changing the way we use and produce energy is fundamentally an issue of national security, it is an economic necessity, and it is the responsible thing to do as custodians of the environment.”

–Secretary of the Navy Ray Mabus

- Six pilot projects to demonstrate biomass conversion for fuel use.<sup>32</sup>
- Developing a 30-megawatt geothermal project at Hawthorne Army Depot, Nev.<sup>33</sup>
- Adopting model performance contracting arrangements at Fort Leavenworth, Kan., whereby energy efficiency improvements are made by a private-sector firm at no upfront cost to the Army, with resulting savings shared by the base and the contractor.<sup>34</sup>
- Investing American Recovery and Reinvestment Act funds in lighter, more-deployable power systems and micro-grids for use in forward operating bases.<sup>35</sup>

## U.S. Navy Initiatives

Approximately 75 percent of the Navy's total energy usage is from sea operations, while 25 percent is used for shore operations.<sup>36</sup> The Navy accounts for approximately 25 percent of DoD's total use of petroleum.<sup>37</sup> Shipboard diesel fuel is the leading naval energy requirement, accounting for 51 percent of the Navy's overall petroleum use, followed by aviation fuel at 42 percent.<sup>38</sup>

The Navy has taken significant steps to respond to the twin challenges

of climate change and energy use. In particular, the service formed two panels, Task Force Energy and Task Force Climate Change.<sup>39</sup>

In October 2009, Secretary of the Navy Ray Mabus indicated that the service would invest \$550 million in energy-efficiency efforts that would yield \$400 million a year in savings.<sup>40</sup>

Secretary Mabus also set forth far-reaching energy plans and goals for both the Navy and Marine Corps, including:



The U.S. Navy's Energy Security logo adorns an F/A-18 Super Hornet.

Mass Communication Specialist 2nd Class Clifford L.H. Davis



Sailors aboard the USS Makin Island offer a salute during a recent visit to Rio de Janeiro.

- Offering incentives to industrial suppliers to meet targets for energy and system efficiency, including examining systems' lifecycle energy costs, evaluating the fully burdened cost of fuel and the contractor's own energy footprint.
- Reducing the Department of the Navy's petroleum use in the commercial fleet by 50 percent by 2015.
- Launching the "Great Green Fleet," a strike group fueled completely by alternative fuels, by 2016.
- Producing half of all shore-based energy requirements from alternative sources and ensuring that half of all its bases be net-zero in energy consumption by 2020.

- Ensuring that 50 percent of the total energy consumed by the Navy, ashore and afloat, will come from alternative energy by 2020.<sup>41</sup>

The Navy is already making strides in the development of energy-saving and alternative-energy technologies. For example, the *USS Makin Island*, commissioned in October 2009, will be the first amphibious assault ship to use a hybrid gas turbine/electric drive machinery plant. Fuel savings are expected to reach \$250 million over the life of the ship.<sup>42</sup>

The Navy also is conducting tests to certify algae and camelina-based biofuels for use in jet aircraft fuel and as shipboard diesel fuel. Conducting

local operations in 2012 and capable of deployment in 2016, the Great Green Fleet will include an aircraft carrier, submarine, cruiser and destroyer running on alternative fuels, with an additional destroyer powered by an innovative hybrid electric drive.<sup>43</sup> The carrier group's air wing also will run on alternative fuels. This spring, the Navy plans to conduct aircraft test flights of an F/A-18 Super Hornet powered by a biofuels blend at Patuxent River Naval Air Station, Md.—a program known as the Green Hornet.<sup>44</sup>

Other key priorities for the Navy include quieter, more-efficient helicopter rotor blades; fuel-cell-powered unmanned aerial vehicles; advanced hull coatings; propeller pitch controls; and modifications to aircraft engines to help reduce energy consumption in aircraft and ships.<sup>45</sup>

Since 1999, the Navy has provided energy-saving incentives to ships, and it is now exploring how incentives can be expanded to naval aviation. In fiscal 2008, efficient ships saved \$136 million in energy costs, equivalent to about 1.1 million barrels of fuel.<sup>46</sup> This came about by awarding \$2 million in incentive payments to ships that conserved energy (up to \$67,000 per ship), funds that can be used for uniforms, laptops or other consumables.<sup>47</sup> These energy savings are achieved through more efficient navigation, efficient loading of engines and simply turning off lights.<sup>48</sup>

## U.S. Air Force Initiatives

The Air Force is DoD's largest energy user, spending some \$9 billion on energy in 2008: 84 percent for aviation fuels and

The solar array at Nellis Air Force Base, Nev., right, is one of the largest in North America.

It provides a quarter of the base's energy.



Airman 1st Class Nadine Y. Barclay, U.S. Air Force



A KC-135R Stratotanker delivers fuel to an F-22 Raptor. The Air Force consumes 2.5 billion gallons of aviation fuel a year.

12 percent for facilities.<sup>49</sup> To put this in perspective, it has been estimated that the Air Force spends \$10 million a day on energy<sup>50</sup> and consumes 2.5 billion gallons of aviation fuel a year.<sup>51</sup>

To help reduce its energy use, the Air Force created a comprehensive energy program and policy, *Air Force Energy Plan 2010*. The objective is to “make energy a consideration in all that we do.”<sup>52</sup>

The plan focuses on three goals:

- **Reduce demand**—across aviation, ground operations and installations. These recommendations include using flight simulators to save fuel for training purposes, reconfiguring flight
- **Increase supply**—focusing on developing renewable and alternative energy for aviation, ground operations and installations. These goals include meeting 25 percent of base energy needs with renewable energy sources by 2025 and obtaining 50 percent of aviation fuels from biofuel blends by 2016.
- **Change the culture**—focusing on Air Force members embracing saving energy as part of their core competencies. This includes energy awareness training and educational materials provided to all Air Force members.<sup>53</sup>

“Using energy wisely is the cornerstone of building an Air Force capable of complete air domination, for today, tomorrow and beyond.”

—*Air Force Energy Plan 2010*

## “Energy choices can save lives on the battlefield.”

—Gen. James T. Conway, commandant of the Marine Corps

During the past six years, the Air Force has reduced energy consumption at the facility and mobility level by almost 20 percent, and yet the service's energy bill has increased by about 300 percent as a result of increased fuel prices.<sup>54</sup> “These budgetary realities have caught the attention of senior Air Force leaders,” said Michael F. McGhee, acting deputy assistant secretary of the Air Force for energy, environment, safety and occupational health.<sup>55</sup>

The Air Force leads all federal entities in clean-power purchasing, with 37 bases meeting some portion of their electrical requirements with renewable sources, according to Air Force sources.<sup>56</sup> For example, Nellis Air Force Base, Nev., is home to one of the largest solar arrays in North America, providing more than 25 percent of base energy, saving \$1 million and reducing carbon dioxide emissions by 24,000 tons annually. The Soaring Heights community at Davis-Monthan Air Force Base, Ariz., currently under construction, will rely on solar power for 75 percent of its residential needs and will be one of the nation's largest distributed, community-wide solar power systems.<sup>57</sup> This installation is expected to offset more than 570 million pounds of carbon dioxide during its lifetime, equivalent to taking approximately 50,000 cars off the road for a year.<sup>58</sup>

## U.S. Marine Corps Initiatives

Gen. James T. Conway, the Marine Corps commandant, has prioritized energy efficiency in facilities, operations and expeditionary capabilities. At the 2009 Naval Energy Forum, he called for net-zero operations on Marine installations, envisioning “bases and stations [that] provide as much energy as they make use of.”<sup>59</sup>

In August 2009, General Conway convened the first Marine Corps Energy Summit and announced an Energy Office at Marine Corps headquarters with a mandate to develop a comprehensive energy strategy and meet 10 goals by the end of 2010. The “10x10 campaign” will help save energy, secure reliable supplies and reduce life-cycle operating costs. It will guide the achievement of three of the Corps' long-term energy goals:

- Reducing energy intensity 30 percent by 2015, relative to a 2003 baseline.
- Reducing water-consumption intensity 16 percent by 2015, from a 2007 baseline.
- Increasing renewable electric energy to 25 percent by 2025.<sup>60</sup>

In Iraq, the Marine Corps has joined the Army in pioneering tests of energy-efficiency foams that can be applied



Humanitarian missions, like this one in the Philippines, are expected to become more prevalent as climate change continues to uproot people.

to temporary structures to reduce energy consumption 50 to 75 percent.<sup>61</sup> Though this process renders the tents permanently immovable, the financial investment in this simple and effective energy-efficiency measure is paid back in less than three months of use.<sup>62</sup>

The Marine Corps conducted the first energy audit of an expeditionary force in a combat zone, deploying experts to Afghanistan in August 2009.<sup>63</sup> Drawing

on the experience of the audits in-country, the service is constructing an Experimental Forward Operating Base. This demonstration project will test expeditionary energy- and water-efficient products and systems for accelerated deployment in-theater.<sup>64</sup> The Marine Corps also plans to retrofit its tactical vehicles with smart electric-power generators, reducing the need for inefficient stand-alone generators.<sup>65</sup>

“Addressing the consequences of changes in the Earth’s climate is not simply about saving polar bears or preserving the beauty of mountain glaciers. Climate change is a threat to our national security. Taking it head-on is about preserving our way of life.”

—retired Navy Vice Adm. Lee F. Gunn, president, American Security Project and CNA Military Advisory Board Member

## CONCLUSION

The military has clearly recognized and is responding to the twin threats of energy dependence and climate change. Leading by example, the four services have embraced the strategic and operational imperatives of energy efficiency and the use of alternative energy systems at both facility and operational levels. The department has set ambitious energy goals, and signs of growing competition for leadership among the branches are evident. Today's military leaders clearly understand that forward-looking approaches to energy and climate can save lives and money and reduce emissions.

Each of the services has established institutional capabilities for developing the plans and policies needed to reduce energy demand, increase supplies of alternative-energy sources and ensure that U.S. troops have the best technologies to complete their missions. These efforts are increasingly amplified by DoD-wide coordination and leadership.

The U.S. government's progress on energy management has been most significant at the facilities level, where DoD is at the forefront of the government's efforts to reduce energy intensity. In addition, the government has initiatives under way to reduce energy demand through energy-efficiency improvements and to increase energy supply through development of alternatives, particularly for facility and transportation purposes.

While work remains to be done, the military continues to build on its successful record in managing resources and investing in long-term innovations. DoD is well-positioned to help manage the threats caused by climate change, to assist in the transformation to a clean energy economy, and to compete effectively in the worldwide development of new energy technologies. In its far-reaching efforts to meet these challenges and keep the United States strong, American servicemen and women are once again leading by example.

# Endnotes

<sup>1</sup> National Defense Authorization Act for Fiscal Year 2008, P.L. 110-81, Section 951(a) (2007).

<sup>2</sup> CNA, *Powering America's Defense: Energy and the Risks to National Security*, May 2009, p. 21, [www.cna.org/nationalsecurity/energy](http://www.cna.org/nationalsecurity/energy).

<sup>3</sup> Mike Boyd, head of the Marine Corps' Engineer Advocate Branch (briefing to the Marine Corps Energy Summit, "USMC Operational Energy Efforts and Challenges, 9/11 to Now!" Aug. 13, 2009), [www.marines.mil/unit/logistics/Documents/Conferences/USMCEnergySummit/Mike\\_Boyd.pdf](http://www.marines.mil/unit/logistics/Documents/Conferences/USMCEnergySummit/Mike_Boyd.pdf).

<sup>4</sup> *Ibid.*

<sup>5</sup> Government Accountability Office (GAO), *Defense Management: DoD Needs to Increase Attention on Fuel Demand Management at Forward-Deployed Locations*, February 2009, p. 47, [www.gao.gov/new.items/d09300.pdf](http://www.gao.gov/new.items/d09300.pdf).

<sup>6</sup> CNA, p. 11.

<sup>7</sup> GAO, p. 9.

<sup>8</sup> Dorothy Robyn, deputy undersecretary of defense for installations and environment (testimony to the Senate Homeland Security and Governmental Affairs Subcommittee on Federal Financial Management, Government Information, Federal Services and International Security, Jan. 27, 2010), [http://hsgac.senate.gov/public/index.cfm?FuseAction=Hearings.Hearing&Hearing\\_ID=c7cb1779-8aa1-4250-8dfe-18e06b579af1](http://hsgac.senate.gov/public/index.cfm?FuseAction=Hearings.Hearing&Hearing_ID=c7cb1779-8aa1-4250-8dfe-18e06b579af1).

<sup>9</sup> Defense Science Board Task Force on DoD Energy Strategy, *More Fight—Less Fuel*, February 2008, p. 11.

<sup>10</sup> DoD Office of the Director, Defense Research and Engineering, *Highlights of DoD's Energy Security Efforts*, 2008, p. 2, [www.dod.mil/ddre/doc/DoD\\_Energy\\_Security\\_Task\\_Force.pdf](http://www.dod.mil/ddre/doc/DoD_Energy_Security_Task_Force.pdf).

<sup>11</sup> *More Fight—Less Fuel*, p. 42.

<sup>12</sup> *Ibid.*, p. 11.

<sup>13</sup> Robyn.

<sup>14</sup> *Ibid.*

<sup>15</sup> GAO, p. 8.

<sup>16</sup> Brookings Institution, *Fueling the "Balance": A Defense Energy Strategy Primer*, Jerry Warner, P. W. Singer, Foreign Policy Paper Series No. 17, August 2009, p. 2, [www.brookings.edu/papers/2009/08\\_defense\\_strategy\\_singer.aspx](http://www.brookings.edu/papers/2009/08_defense_strategy_singer.aspx).

<sup>17</sup> Defense Science Board Task Force on Improving Fuel Efficiency of Weapons Platforms, *More Capable Warfighting Through Reduced Fuel Burden*, May 2001, p. ES-3, [www.acq.osd.mil/dsb/reports/ADA392666.pdf](http://www.acq.osd.mil/dsb/reports/ADA392666.pdf).

<sup>18</sup> Navy Secretary Ray Mabus (address to Naval Energy Forum, Oct. 14, 2009, McLean, Va.), [www.navy.mil/navydata/people/secnav/Mabus/Speech/SECNAV%20Energy%20Forum%2014%20Oct%2009%20Rel1.pdf](http://www.navy.mil/navydata/people/secnav/Mabus/Speech/SECNAV%20Energy%20Forum%2014%20Oct%2009%20Rel1.pdf).

<sup>19</sup> DoD, *Quadrennial Defense Review Report*, February 2010, p. 85, [www.defense.gov/qdr/QDR%20as%20of%2029JAN10%201600.pdf](http://www.defense.gov/qdr/QDR%20as%20of%2029JAN10%201600.pdf).

<sup>20</sup> Executive Order 13423, Section 2, codified by the Energy Independence and Security Act of 2007, P.L. 110-1140, Section 431. [www.gsa.gov/Portal/gsa/ep/contentView.do?contentType=GSA\\_BASIC&contentId=22395](http://www.gsa.gov/Portal/gsa/ep/contentView.do?contentType=GSA_BASIC&contentId=22395).

<sup>21</sup> *Highlights of DoD's Energy Security Efforts*, p. 2.

<sup>22</sup> *Ibid.*

<sup>23</sup> Conversation with K. Brandt, Office of the Secretary of the Navy, Feb. 25, 2010.

<sup>24</sup> *American Recovery and Reinvestment Act of 2009: Department of Defense Near Term Energy-Efficient Technologies Program Plan*, May 15, 2009, p. 2, [www.defense.gov/recovery/plans\\_reports/2009/may/Recovery\\_Act\\_NTEET\\_Program\\_Plan\\_15\\_May\\_2009.pdf](http://www.defense.gov/recovery/plans_reports/2009/may/Recovery_Act_NTEET_Program_Plan_15_May_2009.pdf).

<sup>25</sup> *Army Energy Security Implementation Strategy*, Army Senior Energy Council and the Office of the Deputy Assistant Secretary of the Army for Energy and Partnerships, Jan. 13, 2009, p. 14, [www.asaie.army.mil/Public/Partnerships/doc/AESIS\\_13JAN09\\_Approved%204-03-09.pdf](http://www.asaie.army.mil/Public/Partnerships/doc/AESIS_13JAN09_Approved%204-03-09.pdf).

<sup>26</sup> *Ibid.*

<sup>27</sup> *Ibid.*, p. 4.

<sup>28</sup> *U.S. Army Energy Strategy for Installations*, July 2005, p. 7, [http://dodfuelcell.cecer.army.mil/library\\_items/Army\\_Energy\\_Strategy.pdf](http://dodfuelcell.cecer.army.mil/library_items/Army_Energy_Strategy.pdf).

<sup>29</sup> *Army Energy Security Implementation Strategy*, p. 12.

<sup>30</sup> *More Fight—Less Fuel*, pp. 6-7.

<sup>31</sup> Kevin T. Geiss, Office of the Assistant Secretary of the Army for Installations and Environment, e-mail exchange with authors, Feb. 16, 2010.

<sup>32</sup> *Ibid.*

<sup>33</sup> Geiss (briefing on Army energy security, Aug. 11, 2009).

<sup>34</sup> *Ibid.*

<sup>35</sup> *Defense Near Term Energy-Efficient Technologies Program Plan*.

<sup>36</sup> Rear Adm. Philip H. Cullom, director of fleet readiness (“Navy Task Force Energy” briefing to American Society of Naval Engineers, Feb. 23, 2010).

<sup>37</sup> *Ibid.*

<sup>38</sup> *Ibid.*

<sup>39</sup> Adm. Gary Roughead, chief of naval operations, at CNO Environmental Awards Ceremony, May 28, 2009, Washington, [www.navy.mil/navydata/leadership/mist.asp?x=S&yr=2009&o=5](http://www.navy.mil/navydata/leadership/mist.asp?x=S&yr=2009&o=5).

<sup>40</sup> Mabus, at Naval Energy Forum.

<sup>41</sup> *Ibid.*

<sup>42</sup> U.S. Navy, “Makin Island Conserves \$2 M in Fuel During San Diego Transit,” *Aerospace and Defence News*, Sept. 16, 2009, [www.asdnews.com/news/23176/Makin\\_Island\\_Conserves\\_\\$2\\_M\\_in\\_Fuel\\_During\\_San\\_Diego\\_Transit.htm](http://www.asdnews.com/news/23176/Makin_Island_Conserves_$2_M_in_Fuel_During_San_Diego_Transit.htm).

<sup>43</sup> Mabus, Veterans for American Power, Feb. 23, 2010.

<sup>44</sup> *Ibid.*

<sup>45</sup> Roughead.

<sup>46</sup> Ewing, P., “More COs conserving fuel as part of program,” *Navy Times*, April 13, 2009, [www.navytimes.com/news/2009/04/navy\\_efficiency\\_041209w](http://www.navytimes.com/news/2009/04/navy_efficiency_041209w).

<sup>47</sup> *Ibid.*

<sup>48</sup> *Ibid.*

<sup>49</sup> Michael F. McGhee, acting deputy assistant secretary of the Air Force for energy, environment, safety and occupational health (handout at National Security, Energy and Climate Forum, Sept. 30, 2009).

<sup>50</sup> Bolton, Brig. Gen. E. L. Jr., "Energy Use: Moving in the right direction," *Air Force Space Command News*, Oct. 2, 2009, [www.afspc.af.mil/news/story.asp?id=123170948](http://www.afspc.af.mil/news/story.asp?id=123170948).

<sup>51</sup> *Air Force Energy Plan 2010*, p. 4, [www.safie.hq.af.mil/shared/media/document/AFD-091208-027.pdf](http://www.safie.hq.af.mil/shared/media/document/AFD-091208-027.pdf).

<sup>52</sup> *Ibid.*, p. 5.

<sup>53</sup> *Ibid.*, p. 8.

<sup>54</sup> McGhee.

<sup>55</sup> *Ibid.*

<sup>56</sup> Anderson, W. C., "Air Force continues success in reducing energy impact," Air Force website, Oct. 12, 2007, [www.af.mil/news/story.asp?id=123071452](http://www.af.mil/news/story.asp?id=123071452).

<sup>57</sup> "Arizona Air Force Base Community to Rely 75% on Solar," *Environmental Leader*, Oct. 27, 2009, [www.environmentalleader.com/2009/10/27/arizona-air-force-base-community-to-rely-75-on-solar](http://www.environmentalleader.com/2009/10/27/arizona-air-force-base-community-to-rely-75-on-solar).

<sup>58</sup> "Soaring Heights Communities at Davis-Monthan Air Force Base to Become Largest Solar-Powered Community in the Continental U.S. to Date," *Business Wire*, Oct. 26, 2009, [www.businesswire.com/portal/site/home/email/headlines/?ndmViewId=news\\_](http://www.businesswire.com/portal/site/home/email/headlines/?ndmViewId=news_)

[view&newsLang=en&div=-564504432&newsId=20091026005473](http://view&newsLang=en&div=-564504432&newsId=20091026005473).

<sup>59</sup> Chavanne, B. H., "Marine Corps Pushes for Energy Efficiency," *Aviation Week*, Oct. 15, 2009, [www.aviationweek.com/aw/generic/story\\_generic.jsp?channel=defense&id=news/FFF101509](http://www.aviationweek.com/aw/generic/story_generic.jsp?channel=defense&id=news/FFF101509).

<sup>60</sup> Payne, Maj. Gen. E. G., Marine Corps assistant deputy commandant for installations and logistics, "Facilities & Garrison Mobile Equipment Energy Programs—Present & Future," Aug. 13, 2009, [www.marines.mil/unit/logistics/Documents/Conferences/USMCEnergySummit/MajGen\\_Payne.pdf](http://www.marines.mil/unit/logistics/Documents/Conferences/USMCEnergySummit/MajGen_Payne.pdf).

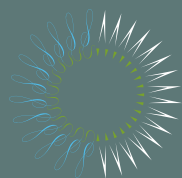
<sup>61</sup> Boyd, "USMC Operation Energy Efforts and Challenges."

<sup>62</sup> *Ibid.*

<sup>63</sup> "US Marine Corps goes green in Afghanistan," *Telegraph*, Aug. 14, 2009, [www.telegraph.co.uk/earth/energy/6025460/US-Marine-Corps-goes-green-in-Afghanistan.html](http://www.telegraph.co.uk/earth/energy/6025460/US-Marine-Corps-goes-green-in-Afghanistan.html)

<sup>64</sup> Marine Corps Col. Robert Charette, conversation with authors, Jan. 29, 2010.

<sup>65</sup> *Ibid.*



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## REENERGING AMERICA'S DEFENSE MILITARY BASES AND ENERGY CONSERVATION AT A GLANCE

The Department of Defense has taken major steps to develop and deploy a strategy to reduce energy consumption and carbon emissions. The department, with an energy budget of \$20 billion, accounts for nearly 80 percent of the U.S. government's energy consumption. For every \$10 increase in the per-barrel price of oil, DoD incurs more than \$1.3 billion in additional energy costs. But in addition to the financial costs, security risks also are posed by climate change, which DoD addressed for the first time in the 2010 *Quadrennial Defense Review Report*, declaring, "[C]limate change ... may act as an accelerant of instability or conflict, placing a burden to respond on civilian institutions and militaries around the world." With clear concerns about the links between climate change, energy and national security, military bases around the country are taking steps to reduce their dependence on fossil-based fuels, become more energy efficient, reduce carbon emissions and develop innovative solutions using clean energy technology.

### CASE STUDIES



**Naval Air Station Oceana, Va.** Oceana was one of two Navy installations to receive the 2009 Presidential Award for Leadership in Federal Energy Management. In its efforts to become more energy efficient, the station installed 4,000 tons of geothermal heat pumps to replace an inefficient steam plant that powered most of the base.<sup>1</sup> In November 2009, Oceana broke ground on a heating, ventilation and air conditioning system (HVAC), which will serve 42 base buildings including hangars, aircraft simulator buildings and housing facilities. This state-of-the-art HVAC system will decentralize heating and air conditioning and use a digital control system to allow for temperature fluctuations in order to ensure maximum efficiency. Along with lighting retrofits and water-conservations measures, Oceana estimated an annual savings of \$4 million.<sup>2</sup>



**Marine Corps Base Camp Lejeune, N.C.** Construction is under way on the largest neighborhood of Leadership in Energy and Environmental Design (LEED)-certified homes in North Carolina. The 537 sustainable homes are slated to be the first LEED-certified houses on a Marine base.<sup>3</sup> LEED homes have lower utility costs through dual-flush toilets, energy-efficient appliances, compact fluorescent lighting, thicker insulation and other energy-savings measures.



**Eglin Air Force Base, Fla.** At Eglin in March 2010, the Air Force conducted its first successful flight of a jet powered entirely by a biofuel blend. Conventional fuel was blended with a hydrotreated renewable jet (HRJ) fuel to power the A-10 Thunderbolt II, or “Warthog.”<sup>4</sup> According to Alternative Fuels Certification officials, the camelina fuel blend and its refining process are cleaner than conventional fuels. This pioneering flight is an important step toward achieving the Air Force’s goal of acquiring 50 percent of its aviation fuel from alternative sources by 2016. In the meantime, the service hopes to have its entire aircraft fleet certified to fly with alternative fuels by 2012.



**Fort Irwin Army Base, Calif.** By using thick insulating foam and solar-reflective coatings on the tents that house brigades of 4,000 to 5,000 troops during their month of training before deploying to Iraq or Afghanistan, Fort Irwin has cut 35 million tons of carbon emissions—the equivalent of taking 3,500 vehicles off the road. As a result of tent retrofitting, the post for the first time did not need a permit allowing it to exceed California emissions limits. The installation also plans to build a 500-megawatt solar project on unused land that serves as a buffer between the base and its neighbors. Because 40 megawatts would be enough to power the post, the rest of the energy could be sold back to the grid and contributed to California’s goal of acquiring 33 percent of its energy from renewable sources by 2020.

*For more information on the military’s energy conservation strategy, refer to [Reenergizing America’s Defense](#), a report documenting how the armed forces are working for a more secure energy future and preparing for the potential impacts of climate change by retrofitting bases around the country to conserve energy and become more efficient. The report can be found at [www.pewclimatesecurity.com](http://www.pewclimatesecurity.com).*

- 1 White House Council on Environmental Quality, “Presidential Awards Presented to Six Federal Agencies for Saving Tens of Millions in Energy Costs, Reducing Consumption and Pollution,” news release, Oct. 29, 2009, [www.whitehouse.gov/administration/eop/ceq/Press\\_Releases/October\\_29\\_2009](http://www.whitehouse.gov/administration/eop/ceq/Press_Releases/October_29_2009)
- 2 U.S. Navy Web site, “Energy Savings Contract to Save NAS Oceana \$4 Million Annually,” Nov. 21, 2009, [www.navy.mil/search/display.asp?story\\_id=49792](http://www.navy.mil/search/display.asp?story_id=49792).
- 3 Littlejohn Engineering Associates, “Camp Lejeune to have First LEED Certified Neighborhood on a Marine Corps Base,” June 11, 2009, [www.leainc.com/index.php?id=591](http://www.leainc.com/index.php?id=591).
- 4 J. Paur, “Air Force Debuts Biofuel-Guzzling Warthog,” *Wired*, March 30, 2010, [www.wired.com/dangerroom/2010/03/air-force-debuts-biofuel-guzzling-warthog](http://www.wired.com/dangerroom/2010/03/air-force-debuts-biofuel-guzzling-warthog).
- 5 S. King Jr., “Air Force officials take step toward cleaner fuel, energy independence,” Eglin Air Force Base Web site, March 26, 2010, [www.eglin.af.mil/news/story.asp?id=123196918](http://www.eglin.af.mil/news/story.asp?id=123196918).
- 6 *Ibid.*
- 7 A. Zavis, “Military embraces green energy, for national security reasons,” *Los Angeles Times*, April 26, 2009, <http://articles.latimes.com/2009/apr/26/local/me-army-green26>.
- 8 *Ibid.*