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Cutting the Tether

ENHANCING THE U.S. MILITARY'S ENERGY PERFORMANCE

by James Morin

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Cover Photo: Senior Aircraftman Matty Amin provides security for a convoy of fuel trucks in Kandahar, Afghanistan. (ISAF photo by Mass Communication Specialist 1st Class John Collins, U.S. Navy)

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"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

"The Department of Defense has been an engine of innovation, pioneering development of cutting edge technologies such as the internet and global positioning systems. Building on this record, the Department will continue to help the United States develop and deploy the clean energy technologies our nation and our troops need to be safe, secure and prosperous in the future."
— retired U.S. Senator John W. Warner

"Energy choices can save lives on the battlefield."
— Gen. James T. Conway, commandant of the Marine Corps

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Executive Summary

The Defense Department has embarked on an important set of reforms that focuses on the impact of our energy policies on our armed forces. However, while there is wide agreement on the objectives, and brilliant efforts have already led to some victories, successes are still few and far between. There are islands of excellence, but we are in need of a continent.

The need for action is clear. First and foremost, we need to **reduce the vulnerabilities to our armed forces** posed by 20th-century strategies regarding energy. A prime example is the high casualty levels suffered by troops guarding oil and water convoys.

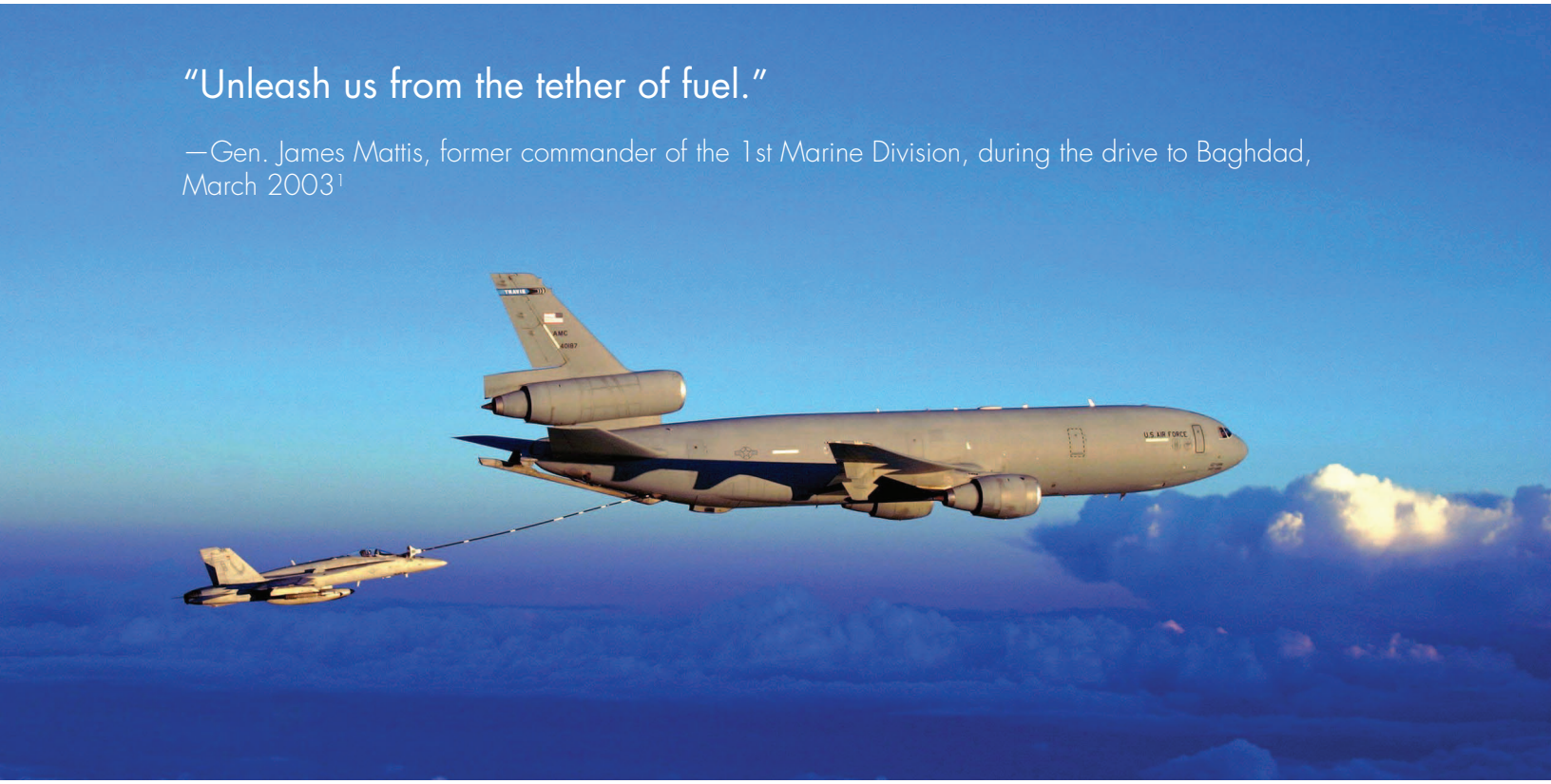
Second, we need to **reduce overall fuel cost and price volatility**. For decades, the Pentagon has failed to accurately capture the cost of fuel. This failure has consequences for both our actual budget as well as our strategic posture.

Third, we must **increase energy security**. Our foreign policy and national security decisions too often are influenced or even driven by concerns about our fuel supply.

Fourth, we need to **adapt and cope with climate change**. The dangers of "climate refugees," changing borders and aggravated social problems in the developing world present an active and increasing security threat for the U.S. and our allies, and perceived indifference will only diminish global respect for the U.S.

"Unleash us from the tether of fuel."

—Gen. James Mattis, former commander of the 1st Marine Division, during the drive to Baghdad, March 2003[1]



A Navy F/A-18 Hornet fighter receives fuel from a KC-10 Extender over Afghanistan, off-loading 2.4 million pounds of fuel to 210 receiving aircraft in one day. (DOD photo by Navy Lt. Peter Scheu)

In this paper, we recommend that the Pentagon redouble its efforts on energy as part of a larger strategy to achieve a more efficient and effective security posture. This paper focuses on the concept of "energy performance," which encompasses where the military gets its energy and how it uses it. We believe that maximizing energy performance will require, in large part, increasing the use of renewable energy, energy efficiency and more strategically favorable sources of energy. After a summary of the current costs and liabilities associated with the Pentagon's energy posture — and some of the efforts already taken to strengthen it — this paper gives an explanation of several potential solutions going forward:

- **Reform the acquisitions process.** The Pentagon should fully account for the cost of battlefield fuel in all purchasing and logistical decisions.

- **Improve in-theater energy performance.** The military should implement new energy-performance technology at forward operating bases and other battlefield locations.

- **Boost clean energy and efficiency at all Defense Department installations.** For domestic bases, in particular, decreasing dependence on fossil fuels and the public electricity grid removes potential liabilities.

- **Strengthen research and development and enhance commercialization of nascent clean energy technologies.** By taking an active role as developer and customer, the Pentagon can help scale up clean tech innovations.

These efforts would ultimately save considerable taxpayer dollars, strengthen the resilience of U.S. forces and yield innovations that not only would enhance the military's energy performance but also boost American competitiveness.

Energy in Modern Warfare

Napoleon famously stated, "An army marches on its stomach." Today, logistics are as critical as ever, but depend on fuel for engines rather than fodder for horses. With the advent of mechanization in the late 19th and early 20th century, fossil fuels became the basic sustenance of an army in the field or a navy at sea. Naval forces first relied on coaling stations, until the switch to diesel gave forces more independence and mobility. The Allied air campaign to destroy German oil refinery capacity was one of the most costly and heroic efforts of World War II. General Patton's Third Army and its thrust across France into the German heartland might have cut short the war in Europe had it not literally run out of gas.

As warfare enters the digital age, warfighters' reliance on energy has become greater — and more risky. Today's armed forces are incredibly dependent on power to support computer systems, satellite communications and digitized weaponry on the battlefield. Friends and foes alike note the vulnerability entailed by such intense energy use. The average soldier in Afghanistan burns through 22 gallons of fuel per day to power vehicles and generators.[2] That fuel must be brought from ports in Pakistan, driven by contracted trucks over precipitous mountain roads and delivered to remote military outposts. In extreme circumstances, fuel can cost as much as $400 a gallon, factoring in the full cost of transport and security.[3]

Potential strategic competitors are rapidly embracing "anti-access" weapons systems, which military analysts believe will allow them to disrupt lines of communication and supply.[4] Such a threat is more than theoretical. In one particular month in Iraq, Pentagon officials blamed insurgents for the destruction of 44 vehicles and 220,000 gallons of fuel.[5] Far more tragically, there were 132 fuel supply-related casualties in Iraq in 2007, and casualty factors per

Soldiers of the 25th Combat Aviation Brigade conduct convoy operations training, transporting 80 vehicles prior to deployment. (U.S. Army photo)

fuel convoy in Afghanistan are twice as high, according to calculations by the Army Environmental Policy Institute.[6]

In 2006, Major General Richard Zilmer, commander of troops in Al-Anbar province in Iraq, sent an urgent, top-priority request to the Pentagon for renewable energy-generation equipment, specifically to reduce the need to supply fuel to his forward bases. His request, however, was denied a year later by the Pentagon, which stated that the technology was "not mature enough" for battlefield use.[7]

Another three years have passed. Yet today the Pentagon too often still fails to identify, much less deploy, "mature" energy-generating and -saving technology. Certainly, this has not been for a lack of thought or recognition of the problem. Indeed, the consensus regarding the threat posed by the Pentagon's energy posture has grown over the last decade. In 2001, the Defense Science Board, a federally chartered advisory committee, published a lengthy report, "More Capable Warfighting Through Reduced Fuel Burden." That was followed in 2008 by another, more urgent Defense Science Board report, "More Fight — Less Fuel."

These authoritative publications have been complemented by other reports from various organizations and institutions, including the 2010 Quadrennial Defense Review (QDR), which underpins all national security planning for the U.S. government.[8] For the first time, the QDR directly addressed energy and climate change, concluding that "DoD must incorporate geostrategic and operational energy considerations into force planning, requirements development and acquisition processes,"[9] and noting that climate change was likely to be an "accelerant of instability."[10] The consensus from these reports is clear: The U.S. military must improve its energy performance to reduce the national, strategic and economic liabilities posed by our reliance on fossil fuels.

While the Defense Department accounts for a small fraction of total U.S. energy use, it is widely recognized that the military is especially burdened by its fuel requirements. A spike in global oil prices can constrain or reverse fiscal choices, as the Pentagon must re-allocate funds from other priorities in order to pay its energy bills. Estimates of the 2008 energy budget for the department ran upwards of $20 billion — not including the cost of protecting fuel production and delivery. From the mountain passes of the Pakistan-Afghan border to the Straits of Hormuz to the Somali coastline, the need to safeguard the flow of petroleum is a continuing challenge to our forces. It is estimated that protecting the global oil supply costs the U.S. military between $50 billion and $133 billion annually.[11]

Because it enriches and emboldens countries like Iran, American reliance on petroleum is a strategic liability.

Because it enriches and emboldens countries like Iran, American reliance on petroleum is a strategic liability. It exacerbates our trade deficit and undermines our national security. Indeed, the American Security Project calculates that 68 percent of U.S. petroleum comes from countries with "high" or "very high" risk of political instability.[12]

Also worrisome is the vulnerability of domestic military installations that depend on the public grid. The massive blackout in 2003 demonstrated the fragility of the system, when a tree

branch began a cascade of failures that ultimately put 55 million people in the U.S. and Canada in the dark. One can imagine the ramifications of a concerted attack on the grid, railway routes for coal or natural gas pipelines. These concerns, along with the expectation of rising energy costs, in general, have encouraged the Pentagon to examine alternatives for powering military installations, not just in the U.S. but also on overseas bases, where electric power may come at exorbitant prices. For example, electricity generation costs on Diego Garcia, an island base in the Indian Ocean, run as much as 60 cents per kilowatt hour — many times the utility rate of an average American base.

The final factor compelling a change in the Defense Department's energy consumption is the global consensus on greenhouse gas emissions and climate change. While policy debates on how to deal with the problem continue in the U.S. and elsewhere, many nations and some states have already adopted robust measures to rein in carbon emissions. The federal government is also working to reduce its carbon footprint. Continued military indifference will, therefore, harm our reputation at home and abroad. Moreover, as the QDR recently explained, climate change is expected to spawn erratic occurrences of drought, flooding and storms, thereby compounding social unrest, migration and resource competition in politically and economically stressed areas around the globe. Compounding such circumstances may well spark and accelerate violence. Given the U.S. military's almost indispensable role in peacekeeping and humanitarian aid, it is likely that climate change will further strain its mission set. Our strategic self-interest clearly compels a shift to lower-carbon-emitting power sources for our military needs.

With the problem so overwhelmingly acknowledged by former and current civilian Pentagon leadership, retired four-star generals and a multitude of national security experts and scholars, it is clear that assertive new steps must be taken, and soon. The remainder of this paper discusses four "avenues of approach" to improve the Defense Department's energy posture.

These avenues are complementary to each other and are each organized roughly according to the relevant management stovepipes within the Pentagon bureaucracy. The first focuses on the department's acquisitions process, particularly long-term development of weapons systems and platforms. The second speaks to energy improvements in-theater — the forward operating bases, transport systems and other expeditionary equipment systems. Turning from the battlefield, the third looks at military installations, bases both here and abroad whose power needs and systems differ from those in-theater. The fourth avenue discusses the creation of a "technology accelerator" entity in order to increase the available options for the leadership of all three channels.

Some of the solutions presented here are commonly accepted but not yet adequately implemented; others are novel and worthy of consideration. All are worth exploring as part of the broad range of activities that the Pentagon and supporting agencies can undertake to strengthen our energy posture and minimize the sacrifice required of our service personnel and the cost to taxpayers to fuel our national defense.

Reform the Acquisitions Process

The first step in reforming Defense Department energy use is to systematically account for the cost of fuel into all purchasing and logistical decisions. This new approach would help the Pentagon to make future equipment purchase decisions without the faulty assumptions of easy fuel availability and low prices that have distorted previous acquisitions planning.

According to the 2008 Defense Science Board report, the cost of delivering fuel to battle begins around $15 per gallon and increases deeper into the battle space. As previously noted, that figure fails to include costs for protecting supply convoys. Even in peacetime, fuel delivered in-flight is around $42 per gallon.[13] For a B-52H bomber burning 3,500 gallons of fuel per flight hour,[14] the actual fuel cost can be exorbitant — and is considerably more expensive than when the B-52 airframe was sketched out in 1946.

Part of the problem is the numerical amount at which the department values expected fuel costs. The "fully burdened cost of fuel," the Defense Science Board explains, is a "figure… used to inform decisions at all levels, from design concepts to choice of propulsion systems to technology choices made at the component level by systems engineers to the types of equipment deployed to field installations." The true calculation of this cost includes not just cash spent but also the manpower required to provide it and the operational limitations associated with design under considerations. Unfortunately, the Board reports that the Pentagon has recommended that a peacetime scenario, as opposed to a worst or next-to-worst case one, serves as the basis for fully burdened fuel cost calculations. This position perpetuates the assumption of cheap fuel, distorting our acquisition choices.[15]

As commonly stated in Pentagon circles, "If you cannot measure it, you cannot manage it."[16] A fuel-cost figure more attuned to the realities of modern combat would lead to better procurement and logistics planning. The military has taken a prudent step in hiring top-flight commercial analysts to do an extensive, multi-month study to develop a sophisticated financial model for the consumption of fuel on *Perry* class frigates. Developing similar models across the Pentagon for major weapons platforms will facilitate accurate analysis of the true cost and benefits of various energy-saving technologies. Moreover, the department should carefully meter the fuel consumption of its major systems and high-value "end items" (such as aircraft, tanks and trucks) in order to continue to refine these models and enable better energy management.

A fuel-cost figure more attuned to the realities of modern combat would lead to better procurement and logistics planning.

Another element of the solution is to make energy efficiency an obligatory "key performance parameter" in acquisition decisions. In Pentagon acquisition terminology, a key performance parameter is defined as "those attributes or characteristics of a system that are considered critical or essential to the development of an effective military capability."[17] These can be either mandatory or selectively applied and are always expressed as measurable requirements. Far too often, military acquisitions requests have not included the analytical tools to determine objective, measurable goals, preventing the Pentagon from establishing energy ef-

U.S. Army Spc. Dean Kalogris charges the installation's command sergeant major's electric car on Fort Bliss, Texas. (U.S. Army photo by Maj. Deanna Bague)

ficiency as a key performance parameter. The department should accelerate the process of reforming the performance parameter system, setting challenging but achievable goals in the context of an accurate, fully burdened cost of fuel. An even more ambitious course has been set for Navy and Marine Corps by Secretary Ray Mabus, who intends to include as an "acquisition evaluation factor" the full life-cycle energy costs of a system under consideration, including the energy used to manufacture the equipment.[18]

As an intermediate step, the Pentagon should provide contractors with incentives to incorporate efficiency into system design in the near term, for both existing systems and those currently in production. It should establish procedures to provide rebates to departments, sub-agencies and contractors for a percentage of their additional efficiency gains, even for contracts already awarded and in production. The Obama administration has publicly stated an intention to "increase the use of prizes and challenges as tools for promoting open government, innovation and other national priorities."[19] Indeed, the Pentagon has already been given specific statutory authority to offer such incentives.[20] Defense contractors and suppliers would not only respond to the financial incentives, but public acknowledgment of energy-saving innovations would also bestow goodwill and public relations benefits on winning firms.

Proposals:

- Always account for the fully burdened cost of fuel in the acquisitions process
- Implement metering on high-value end items to inform future decisions
- Implement energy-efficiency key performance parameters as broadly as possible
- Offer incentives to contracts and suppliers to improve energy efficiency

Improve In-Theater Energy Performance

The Commandant of the Marine Corps, Gen. James Conway, has stated that "energy choices can save lives on the battlefield."[21] This is particularly accurate when discussing expeditionary logistics.

Far from the Pentagon hallways, where tomorrow's military equipment is conceived, designed and purchased, warfighters in Afghanistan and Iraq do their best to accomplish their mission with equipment designed and purchased yesterday. They are supported by a long chain of military and civilian logisticians, beginning with the quartermaster right next to them in the theater of operations and ending back at the regional command for the Middle East area and the senior logistics management at the Pentagon. Throughout this chain of supply, tough decisions must be made in balancing cost, reliability and safety while always keeping the mission paramount. These decisions include which equipment and supplies get sent to the front, to whom, how soon and by which mode of transport. Where the acquisitions staff may think about which fighter aircraft to purchase in 20 years, logisticians are deciding what to put in the next shipload of gear to the combat zone.

> To really change the way we provide energy in-theater, the Pentagon needs to increase rapid testing and fielding of new energy-performance equipment for forward-deployed units.

We propose aggressively expanding several processes to improve in-theater energy performance and ease the pressure facing expeditionary logisticians. As a first step, the department needs to improve its analysis and auditing of energy use in combat environments. Revamping those methods is essential to defining the scope of the problem.

A U.S. Navy Grumman F-14 Tomcat receives fuel from an Air National Guard Boeing KC-135 Stratotanker during a combat mission. (U.S. Navy photo by Paul Farley)

The department should also take steps to expedite the flow of existing energy-performance equipment into theater. The Pentagon should consider automatically upgrading the priority of logistics requests for energy-saving equipment and setting rigorous deadlines for procurement and transport of such gear into theater. All four military services, as well as logistics arms, such as the Defense Logistics Agency and the Government Services Administration, should compete to speed existing energy innovations into their expeditionary logistics.

But to really change the way we provide energy in-theater, the Pentagon needs to increase rapid testing and fielding of new and nascent energy-performance equipment for forward-deployed units. One example is micro-grid technology that would allow a small forwar op-

erating base to run its electric generators more efficiently by reducing redundancy and matching generation to need. For example, an analysis of gas-powered generators at Camp Leatherneck in Afghanistan showed that none of the 196 generators running on the base operated in concert with another and that each generator operated at merely a third of its capacity for electric load. In other words, with a more systemic approach to managing the energy supply on the base, two-thirds of the generators could have been shut off with no diminution in overall power. Portable micro-grids would allow such bases to operate with a flexible but appropriately powered utility grid, saving fuel consumption by 25 to 40 percent.[22] Such technology, however, remains unavailable for military procurement.

Better insulation for the tents and temporary buildings that house service members is another source of significant fuel savings. Deployed units have used a sprayable foam, commercially known as Tiger Foam, to dramatically reduce energy requirements on forward operating bases. This improvement quickly pays for itself through savings, but also renders the tent permanently immobile. Similar systems, such as portable insulating tent liners, are available for purchase by the military, but have not yet been sent into theater.

Installing renewable energy systems on forward bases would also enhance a unit's energy performance. Solar, biofuel and wind systems should be implemented to create energy on base, displacing the need to repeatedly transport fuel to bases via convoys. Solar energy, for thermal water heating and electric power generation, is an obvious option in Iraq and Afghanistan, and flexible photovoltaic systems have already shown significant survivability for operational use. The Army has also tested innovative waste-to-energy generators and temporarily deployed them to Iraq in a program known as Tactical Garbage to Energy Refinery.[23] Fielding innovative water purification systems will also reduce requirements to transport bottled water — a burden that consumes staggering resources.

U.S. Navy Mineman Chief Petty Officer Garry Myers provides perimeter security at a natural gas well fire in the Rumaylah Oil Field in Southern Iraq. (U.S. Navy Photo by Specialist James P. Johnson)

There are also energy generation possibilities within existing equipment. The Marine Corps has developed a simple conversion process that would place an electric dynamo near the engine of a standard military Humvee, which would allow it to generate 10kW while moving and 30kW while stationary. The same conversion can be fitted to new cargo trucks.[24] Despite the impressive results from tests of vehicle-generation conversion, only five Humvees and five trucks will be converted this year, and there

is no apparent plan to make this retrofit ubiquitous in the Marine or Army tactical fleets.[25] A hybrid version of the Humvee has been in development since May 2002, yet similarly shows little progress of real implementation.[26]

These are just a few examples of potential solutions to the military's energy challenges. It is clear that many of the solutions already exist but need more time or funding. Many of the ideas we suggest have been already initiated by the Army's Power Surety Task Force and the Marine Corps' Marine Energy Assessment Teams, but the scale of their task has not been recognized in the funding and attention given to their activities.

In a few instances, the problem is not funding but, rather, an inability to find a technological solution to a particular need. Addressing this challenge requires connecting the armed services with the manufacturers who can develop new technology. In March 2010, the Marines invited energy product developers to demonstrate such innovations on the Experimental Forward Operating Base at Marine Corps Base Quantico in Virginia. Several of these technologies will be incorporated in upcoming training exercises. The Army has hosted similar tests as part of Project Eskimo at Fort Irwin in California. Such venues should continue their work, with the hope of eventually allowing the Pentagon to dramatically cut the burden of fuel on logistics while creating a market for innovation at the same time.

Proposals:

- Increase efficiency at forward operating bases through retrofits and improved design
- Automatically upgrade priority of requests for energy-saving equipment in Iraq and Afghanistan
- Procure and deploy portable renewable energy at forward operating bases at scale appropriate for the mission

An army fuel truck sustained damage and exploded in Kabul, Afghanistan. (ISAF Photo by U.S. Air Force Tech Sergeant Brenda Nipper)

Boost Clean Energy and Efficiency at All Defense Department Installations

Scaling up energy-performance technology in the battlefield is important. No less essential, however, is changing the way energy is provided to permanent military installations. Efficiency improvements at bases provide not just long-term economic gains via energy savings, but security benefits as well by taking sensitive installations partially off the electric grid or providing a secure power source for overseas installations that depend on imported oil.

It all begins with the inculcation of an energy-efficiency mindset in the armed services. Responsible energy use should be as much a part of military culture as traditional military courtesy. Our domestic bases exist to support and prepare units defending our country abroad. Part of that preparation must be to instruct units to manage energy as the combat resource that it is. Smart energy management is a skill that must be developed over time, just like marksmanship or mission planning. Its cultivation should eventually lead to improved energy practices both in-theater and on bases.

The Pentagon already has some successful programs in place to reduce energy waste. For example, the Navy has incorporated a very successful energy conservation rebate program that allows a portion of a ship's energy savings to be returned as an award to the most proficient vessels. These rebates can be used for new uniforms, laptop computers or other nonessential items for the ship's crew.[27] Similar programs could be applied to installations as well, encouraging local unit and base commanders to achieve as much progress as their local circumstances allow.

As with energy performance in-theater, installations should meet their unique energy requirements by investing in innovative technologies. The Pentagon's Environmental Security and Technology Certification Program is tasked with promoting such technologies, but the program to date has not received sufficient funding to generate long-term returns on the government's investment. Meanwhile, installation energy managers all too often invest

Solar panels are the sole source of energy for the runway lights at the 45th Operations Group, Detachment 2, at Ascension Auxiliary Airfield (AAF), South Atlantic Ocean. (U.S. Air Force photo by Lance Cheung)

only in "low-hanging fruit" solutions — installing advanced lighting, adding rooftop solar panels — rather than adopting more systemic changes. To date, most of the renewable projects that have been put in place at bases largely use commercially available technologies. Yet a wealth of innovative concepts abounds for energy generation at installations. One example is Ocean Thermal Energy Conversion — a process that generates power simply by exploiting temperature differences in layers of the ocean and could potentially yield large savings in remote locations, such as Diego Garcia or Guam. Other groundbreaking technologies include wave- or tidal-energy generation or even small-scale nuclear generators.

Commercialization of such advances, however, requires full-scale pilot projects, which often do not receive commercial financing. This is particularly true in the risk-averse utility industry, and especially under the continuing shadow of the credit crunch. The services should invest in pilot and demonstration projects for cutting-edge technologies that can be deployed on military installations once they have demonstrated technical and financial feasibility.[28] Dr. Dorothy Robyn, deputy undersecretary of defense for installations and environment, recently articulated this strategy in her testimony to Congress: "For technologies that prove effective, DOD can go on to serve as an early customer, thereby helping create a market, as it did with aircraft, electronics and the Internet."[29]

The Pentagon should also leverage the best of the public and private sectors through the increased use of public-private partnerships. This is already occurring successfully; partnerships with private power developers have led to some of the largest renewable energy projects in the country, including the 13-megawatt solar array at Nellis Air Force Base in Nevada. Energy-saving performance contracts, which allow private entities to be repaid over time for upfront investments in improving energy efficiency, have saved Army installations over $100 million over the last 10 years, according to the Corps of Engineers.[30]

Changes in the military's ability to structure power-purchase agreements could further stimulate utility-scale power generation. Currently, developers and financiers are reluctant to fund upfront costs for new technologies when they cannot predict their ability to recover those costs over a long period of time. Power-purchase agreements should be structured to provide some protection for both the military and developers.

Advancing such projects will require not only greater willingness to share risk, but also long-term planning and active involvement by department-wide leadership (bases are generally administered through the individual services). The Government Accountability Office has found that there is a shortage of installation energy managers with experience in renewable energy systems, impeding adoption and transformation on many bases.[31] While such expertise will surely grow over time, a near-term remedy is the creation of a "Power Innovation Strike Force," a select group of innovative engineers and financiers who can represent the department in developing and arranging alternative financing for clean energy projects. Applying this acute business expertise at the most critical installations could accelerate the development of experimental and cutting-edge projects.

These efforts to fairly allocate risk and structure installation power deals would be complemented by another metric that has been largely absent from previous calculations: a fully burdened cost of electric power. This metric would use a methodology not unlike the full-

burdened cost of fuel, but would encompass national security and other economic factors such as the source and reliability of fuel supply, the cost of guaranteed electric power during an extended grid outage and the predictability of the end-user cost. This figure would allow for clearer decision-making on the business case for innovative projects.

Proposals:

- Instill an energy-efficiency culture within the military
- Invest in pilot and demonstration projects to accelerate readiness for broad-based deployment of new technologies at appropriate installations
- Stimulate such cutting-edge projects through public-private partnerships, innovation-friendly power-purchase agreements and targeted management
- Require national security and broader economic considerations for renewable energy and efficiency projects at installations

USS George Washington and USNS Supply (TAOE 6) sail along side each other just before conducting the first underway replenishment at sea where seven stations are manned. (U.S. Navy photo by Photographer's Mate 1st Class David C. Lloyd)

Strengthen R&D and Enhance Commercialization of Technologies

A final recommendation cuts across the previous three avenues. As mentioned already, while many of the foregoing proposals can be accomplished with existing technology, the largest gains have yet to be discovered. The military, more than any other American institution, has a history of taking nascent technologies and scaling them up. To accelerate the development of budding energy innovations, the military needs to take the lead in research and commercialization.

Radar, GPS and the Internet were initially developed in military research centers, such as the Defense Advanced Research Projects Agency (DARPA). The Pentagon should continue to work through DARPA and the research labs administered by the individual services, as well as expand partnerships with other agencies, such as the Departments of Energy and Agriculture and the Small Business Administration. These partnerships are particularly important for energy performance, since many of the best minds in the energy field have previously focused their endeavors outside of the defense sector and often do not come from large defense contracting companies but rather from small startup companies.

In addition to research, an important role for the Pentagon is to serve as a customer for innovative energy technologies and fuels. In this role, the military can advance technology learning curves to reduce costs and enable private industry to roll out new energy products in scale for the benefit of national security. The department has already awarded contracts for innovative biofuels for testing purposes. The Navy, in particular, has demonstrated interest in and bought limited quantities of algal and camelina-based biofuels.

Too often, however, no industrial scale supplier exists for the energy innovation needs of the department. A problem familiar to other sectors of technical development is the "valley of death" — the divide between a successful research project and the commercialization of that technology. One solution to that problem can be found in the Central Intelligence Agency (CIA). In 1999, the agency created In-Q-Tel, a strategic investment fund operated for the benefit of the CIA that has allowed the agency to invest in and scale up potential solutions to its technology needs. (See sidebar, p. 18.)

A similar construct may be appropriate for Pentagon energy innovation. The recent QDR suggested "the creation of an innovation fund" that would help fund projects "that advance integrated energy solutions" for the department. This fund would be jointly administered by the Pentagon's new director of operational energy plans and programs and the deputy undersecretary for installations and energy.[32] Indeed, In-Q-Tel has already invested in at least one portable renewable energy system: the Mobile Power System built by SkyBuilt Power.[33]

> To accelerate the development of budding energy innovations, the military needs to take the lead in research and commercialization.

While special legal authority already exists for the Pentagon's non-procurement transactions,[34] extensive congressional reporting will be essential to the healthy functioning of such an entity. This reporting must include rigorous and independently conducted audits of expenditures and investments. Also critical to

IN-Q-TEL: A MODEL FOR DEFENSE INNOVATION FUNDING?

In 1999, the Central Intelligence Agency (CIA) found that it was not able to acquire information technology solutions fast enough to accomplish its mission. This led to the creation of In-Q-Tel, Inc., a strategic investment fund operated for the benefit of the CIA but incorporated as a private nonprofit organization.

In-Q-Tel combines attributes of a venture capital fund with other government technology acquisition models. It can make direct equity investments, partner with other private entities, obligate funds in multiyear increments, more easily retain top-quality business talent and commercially borrow to modestly leverage its investments. While its transactions need not comply with Federal Acquisition Regulations, these and certain government intellectual-property transfer requirements must be satisfied when the CIA actually purchases the equipment. A firm's financial support by In-Q-Tel comes with a contractual obligation to provide a work product to the government, exceptionally strict due diligence and ongoing technological expertise from the In-Q-Tel staff.[36]

In-Q-Tel differs from true venture capital firms in that its focus is not on return on equity but on solutions for an IT problem set issued annually by the CIA's IT staff. This singular purpose facilitates the unique and perhaps most significant addition of value offered by In-Q-Tel — "a deep understanding of [its] Government partner's needs, challenges and pain points."[37] This understanding comes from trust and close interaction with its only customer, but is also guarded by the esteemed Board of Trustees that oversees its growth and management, including dignitaries like former Lockheed Martin CEO Norman Augustine, former Secretary of Defense William Perry and Retired General Charles Boyd.[38]

In 1999, then-Director George Tenet envisioned that such an entity could help the CIA "swim in the Valley," scouring Silicon Valley's most innovative and applicable technology for the agency's use.[39] Since its inception, In-Q-Tel has successfully demonstrated the benefits of this agile, entrepreneurial approach, and this "technology accelerator" now supports the entire intelligence community. By March 2008, it had delivered more than 140 technologies to the community, reviewed more than 7,500 business plans and expanded its information-gathering network to hundreds more venture capital firms, labs and other research organizations, ensuring that the intelligence community has access to the most cutting-edge IT. In doing so, for a budget of approximately $50 million a year, it has leveraged $1.4 billion in private-sector funds to support IT for the CIA and its peer agencies.[40]

the success of the program will be the rigorous oversight of a Board of Trustees, who must ensure the entity's focus remains on benefiting the taxpayer and service member.

As a clearinghouse for ideas, it would help build institutional memory of the evolving challenges of military energy needs. This, in turn, would lend focus and continuity amid leadership turnover in the department. Transparent, accountable and knowledgeable in the challenges faced by the military — yet also comfortable in the rapidly evolving energy innovation sector — the new body should help create the conditions for the rapid acquisition of the innovative energy technology needed on the battlefield today and in the future.

Proposals:

- Invest in more traditional R&D for energy innovation
- Ensure that technologies can be brought to commercial scale for defense needs through establishment of a "technology accelerator" entity

Conclusion

In January 1939, the U.S. produced about 100 aircraft a year. As the German blitzkrieg rocked Europe in 1940, the head of the Army Air Corps, then-Major General Henry "Hap" Arnold, told his senior leaders to prepare estimates for the amount of aircraft the U.S. might need. He instructed them to "be bold" as they presented their recommendations. The generals and colonels recommended massive increases, adding several squadrons to the existing structure in what would have been considered a large, if not the largest, peacetime increase in air strength to date.

His response: "Gentlemen, at the outside, even with replacements, this adds up to about 100 planes. To hell with you! I'm going over the White House now, and do you know what I'm going to tell the president? I am going to tell the president that we need 100,000 airplanes." Shortly thereafter, President Roosevelt made a speech setting a seemingly impossible target of 50,000 planes a year. By 1944, American industry was producing 120,000 aircraft annually.[35]

As our history demonstrates, the Pentagon, in cooperation with America's leaders, clearly has the potential for swift and massive action on urgent challenges. The need for significant shifts in Pentagon energy use and consumption has been clear to the highest levels of military leadership for some time. The department needs to assume responsibility for its own fate on this issue and commit to the proper level of funding, human capital, programmatic organization and leadership. Congress must be consistently supportive of those efforts through both prudent oversight and appropriately scaled and targeted appropriations.

The status quo presents an unacceptable hazard to American security interests, budgets and lives. It is clear that significant steps should be taken soon to address this issue on and off the battlefield, in acquisitions for the ongoing wars as well as long-term procurement. It is time to "be bold."

Endnotes

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