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White Paper

Tailored Hybrid Power System: Expeditionary Power Solution for Austere Environments in an Era of Fiscal Austerity





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About the Author

Ronaldo Lachica retired from the U.S. Army in March 2013 and immediately started working for Solar Stik as a Business Development Representative, with the goal of contributing to the implementation of DoD's Operational Energy (OE) Strategy. His primary duty is to interact with military units, Program/Project Offices, and OE policy and decision makers, conveying expeditionary power requirements to Solar Stik's executive and engineering teams. CW4 Retired Lachica has extensive experience providing tactical electric power and logistical support to operational military units, including during two combat tours. In the early stages of Operation Iraqi Freedom, CW4 (R) Lachica established and managed the electrical power grid for a forward operating base (FOB). The grid supplied over 1.5 megawatts of power to support the best possible living conditions for 4,500 troops. CW4 (R) Lachica realized the challenges of transporting fuel to distant Combat Outposts (COPs) during his next combat deployment to Iraq. Army Sustainment Magazine published an article by CW4 (R) Lachica that explores contemporary military energy issues and strategic plans for improvement and culture change.

CW4 (R) Lachica holds a Master of Science degree in Logistics Management from Florida Institute of Technology and a Bachelor of Science degree in Business Administration from Fayetteville State University. CW4 (R) Lachica's military education includes the Theater Logistics Planner Course, Warrant Officer Staff Course, Engineer Equipment Repair Technician Advance Course, and Power Generation Equipment Repairman Advance Course.

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Executive Summary

Lessons learned from combat operations in Iraq and Afghanistan confirm the growing importance of energy with corresponding increases in consumption. Satisfying the increased demand for fossil fuels in support of contingency operations had cost lives, money, and operational effectiveness. Generators are the biggest consumers of fuel on the battlefield. This paper introduces the Tailored Hybrid Power System (THPS). It explains the principles of scalability, modularity, mobility, autonomy, and durability, and shows how meeting these five principles can decrease the frequency of fuel resupply operations that expose the Warfighter to avoidable risks and take critical assets away from the fight. This paper also recommends a tiered procurement concept for THPS solutions that is in line with the Agile Acquisition Strategy and Better Buying Power (BBP) initiatives. BBP initiatives aim to increase efficiencies in the acquisition process in order to "deliver better value to the taxpayer and Warfighter" by placing emphases on tailoring and alternative models for how to structure programs.

The Warfighter needs equipment that can be tailored for requirements generated from energy-informed decisions during mission analysis and operations planning.

A THPS reduces fuel consumption and runtime of fossil fuel generators by sourcing stored energy first and maximizing renewable power generation. However, renewable power systems are expensive and Department of Defense (DoD) can't afford to allocate the equipment for a hybrid power system to every authorized diesel generator. Renewable power technologies also have a short life cycle and move at a pace faster than the traditional acquisition process. Military units are expected to operate in different types of operational environments that require hybrid power solutions of varying scales and configurations. The Warfighter needs equipment that can be tailored for requirements generated from energy-informed decisions during mission analysis and operations planning. Instead of developing and procuring a locked-in hybrid power solution through the traditional acquisition process, DoD should follow an Agile Acquisition Strategy with less defined parameters, enabling the procurement of increasing and continuously evolving THPS components. DoD can ensure there are just enough THPS components for units to train with on a rotational basis according to their training cycle or higher headquarters' priorities. The Warfighter can gain familiarity with hybrid power systems at a minimum but be fully trained when they need it most. The Warfighter will become confident in the effectiveness of hybrid power systems and be better trained to select the optimum hybrid power configurations for any operational environment.

The U.S. Army's Rapid Equipping Force (REF) deployed several commercial off-the-shelf (COTS) hybrid power systems in support of contingency operations. These hybrid power solutions satisfied critical power requirements at austere locations, while at the same time reduced fuel consumption and reliance on ground and aerial resupply. The Marine Corps initiated the Mobile Electric Hybrid Power Sources (MEHPS) program to pave the way for supplementing power generating equipment used in expeditionary operations. Project Manager Mobile Electric Power (PM MEP), in partnership with Marine Corps Systems Command (MARCORSYSCOM), will coordinate MEHPS development for worldwide DoD fielding. MEHPS is a program that will enhance the expeditionary effectiveness of the U.S. military and should receive continued funding for development and procurement. The developmental costs for MEHPS can be significantly reduced by adopting COTS hybrid power solutions deployed by REF that have a successful and proven track record and already meet the five principles of a THPS. This is a critical consideration in today's budget-constrained environment. Agile Acquisition with integrated logistics support similar to traditional acquisition process solutions will provide the Warfighter with the latest hybrid power capability for operations now and in future security environments where traditional fuel availability and logistics may be compromised.

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Introduction

Lessons learned from combat operations in Iraq and Afghanistan confirm the growing importance of energy with corresponding increases in consumption. Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) also exposed the increasing costs and vulnerabilities of transporting energy from the strategic level all the way down to the last tactical mile.[1] In response, the Capstone Concept for Joint Operations specifically recommends the reduction in Operational Energy (OE) requirements and development of viable alternative energy sources as significant considerations in building the Future Force. Fuel consumption of power generating equipment represents the largest portion of the U.S. Army's energy utilization on the battlefield according to the Defense Science Board Task Force on Energy Strategy. The development and fielding of a tailored hybrid power system (THPS), facilitated by improved energy management, will reduce fuel consumption and consequently decrease the frequency of fuel resupply operations that expose the Warfighter to avoidable risks and take critical assets away from the fight. The 2014 Quadrennial Defense Review (QDR) states that "energy improvements enhance range, endurance, and agility, particularly in the future security environment where logistics may be constrained." To better serve the taxpayer—and more importantly the Warfighter—the development and fielding of a THPS should proceed on a similar Agile Acquisition[2] path implemented for modernizing the military's tactical communications network.

The development and fielding of a tailored hybrid power system (THPS), facilitated by improved energy management, will reduce fuel consumption and consequently decrease the frequency of fuel resupply operations that expose the Warfighter to avoidable risks and take critical assets away from the fight.

The U.S. Army's Rapid Equipping Force (REF) deployed several commercial off-the-shelf (COTS) hybrid power systems in support of contingency operations. This was undertaken as part of REF's Energy to the Edge (E2E) initiative. E2E allowed for the expedited delivery of alternative power solutions to the Warfighter conducting operations in remote locations otherwise known as "the tactical edge." These hybrid power solutions satisfied critical power requirements at distant Forward Operating Bases (FOBs), Combat Outposts (COPs), Patrol Bases (PBs), Observation Posts (OPs), and Village Stability Platforms (VSPs) while at the same time reducing fuel consumption and reliance on ground and aerial resupply. The immediate positive impact of E2E demonstrated the potential to save fuel, money, and countless lives.[3]

[1] DoD consumed nearly 5 billion gallons of fuel conducting military operations in 2010, costing $13.2 billion, a 255% increase over 1997 prices. More than 3,000 Army personnel and contractors were wounded or killed in action from attacks on fuel and water resupply convoys in Iraq and Afghanistan from FY 2003 to FY 2007. (DoD Operational Energy Strategy, 2011, pp. 4-5.)

[2] MG Dennis Moran (USA, Ret.), VP of Harris Communications, argues for Agile Acquisition in a December 9, 2013, blog for C4ISR Net.

[3] The AMMTIAC-WSTIAC Journal, Volume 2, Number 1, provides real-world examples of successfully integrating hybrid power systems to ongoing combat operations. One OP had reported savings of 35 gallons of fuel per day while providing 100% operational capability.

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

- USMC Expeditionary Strategy and Implementation Plan, March 2011

The Marine Corps Expeditionary Energy Office (E2O) initiated the Mobile Electric Hybrid Power Sources (MEHPS) program to pave the way for supplementing power generating equipment used in expeditionary operations. MEHPS aims to increase the operational effectiveness, endurance, and capability of a Marine Air Ground Task Force (MAGTF) by reducing the logistical burden of fuel resupply and generator maintenance. Results from the MEHPS Analysis of Alternatives (AoA) determined that it can close five capability gaps identified in USMC's Expeditionary Energy, Water, and Waste (E2W2) Initial Capabilities Document (ICD). MEHPS would enable the automatic matching of load to demand and of power production to consumption. MEHPS would also have the capability to efficiently integrate multiple energy sources, harvest renewable energy, and provide scalable energy storage. USMC had previously deployed solar powered generating systems, such as the Ground Renewable Expeditionary Energy Network System (GREENS), as Program of Record (POR) solutions for low power applications. MEHPS is intended as the POR solution for reducing fuel consumption of higher power applications.[4]

The Department of Defense (DoD) published its Operational Energy (OE) Strategy in May 2011 with the goal of ensuring the 21st century Warfighter has the energy needed to conduct missions across the range of military operations (ROMO). E2E and MEHPS are among the many programs that support the three principal approaches outlined in the OE Strategy aimed at providing energy independence to the Warfighter. Comprehensive and conclusive data on COTS hybrid power solutions deployed through E2E should have significant influence on MEHPS development. Combat proven E2E solutions do not require significant research and development (R&D) to fill current and future OE capability gaps.

[4] USMC presented a MEHPS Brief to Industry on 31 January 2013 at Marine Corps Base Quantico. The briefing identified ExFOB 2013, held in May, as the event that would monitor system performance of available hybrid power systems from industry and inform the requirements development phase.

The MEHPS Brief to Industry identified four categories of systems (see Table 1) with increasing peak power ratings, as well as varying attributes and transport requirements. The categories range from the smallest, designed for the most austere Tier I conditions, to the largest for more established Tier 3 FOBs. The smallest category is intended to be man-portable while the two medium categories allow for all or some components on a Light Tactical Trailer (LTT). Energy storage is considered as an attribute for all but the largest category. The capability to harvest energy from solar is a considered attribute of the two smallest categories.[5] The capability to automatically start and stop the generator is an essential power management feature of efficient hybrid power systems and therefore a common attribute of all categories of MEHPS.

Principles of DoD Operational Energy Strategy

- **More fight, less fuel:** Reduce the demand for energy in military operations
- **More options, less risk:** Expand and secure the supply of energy to military operations
- **More capability, less cost:** Build energy security into the future force

Source: DoD Operational Energy Strategy (May 2011)

Table 1: MEHPS Family of Systems

	Peak Power	Attributes	Transport Requirements
MEHPS Lightweight	3 kW	- Auto-control of single generator - Energy storage - Solar	Each component does not exceed four-man lift
MEHPS Medium	10 kW	- Auto-control of single generator - Energy storage - Solar	All components on LTT
MEHPS Microgrid Medium	60 kW	- Auto-control of multiple generators - Energy storage	Control and energy storage on LTT
MEHPS Microgrid Heavy	300 kW	- Auto-control of multiple generators	Forklift-able

Source: MEHPS Brief to Industry (Jan 2013)

Project Manager Mobile Electric Power (PM MEP), in partnership with Marine Corps Systems Command (MARCORSYSCOM), will coordinate MEHPS development for worldwide DoD fielding and eventually manage the life cycle of resulting hybrid power systems.[6] Product Manager Small Power Systems (PdM SPS), an office within PM MEP, spearheads the joint effort to develop MEHPS Lightweight and MEHPS Medium. MEHPS Microgrid Medium and MEHPS Microgrid Heavy will build on current U.S. Army efforts of developing a more efficient tactical microgrid.

MEHPS is a program that will enhance the expeditionary effectiveness of the U.S. military and should receive continued funding for development and procurement. However, MEHPS development should not follow the traditional POR acquisition process. Renewable power technologies have a short life cycle, much like tactical communications systems, and move at a pace faster than the traditional POR process. The Agile Acquisition process focuses on non-developmental items (NDIs) that require minor modifications of commercially available products to meet military requirements.[7] COTS hybrid power systems deployed by the REF are essentially NDIs.

Agile Acquisition with integrated logistics support similar to traditional Program of Record solutions will provide the Warfighter with the latest hybrid power capability.

[5] Solar is the most technologically advanced renewable energy source. The most efficient utilization of solar power technology for tactical operations is for distributed operations up to 10 kW continuous. (Stikopedia, 2016.)

[6] George Jagels, "Solving Austerity," DoD Power Energy & Propulsion. November 2013. p. 3

The solutions with a successful and proven track record during Operation Enduring Freedom are best poised to fulfill MEHPS requirements in the most efficient and cost-effective manner.

The solutions with a successful and proven E2E track record are best poised to fulfill MEHPS requirements in the most efficient and cost-effective manner. This is a critical consideration in today's budget-constrained environment. This paper will use the Solar Stik System to illustrate some of the THPS' major principles. While there were other proven solutions, this author is most familiar with the Solar Stik solutions. Agile Acquisition with integrated logistics support similar to traditional POR solutions will provide the Warfighter with the latest hybrid power capability. Using NDI is compatible with the concept of the THPS that must be incorporated in the MEHPS program to deliver the most affordable, applicable, and effective expeditionary power solution. The THPS is also compatible with the concept of OE General Support (GS) outlined by LTG Raymond Mason, Deputy Chief of Staff of the Army, G-4 (Logistics) in the September 2013 issue of Army Magazine. OE GS calls for the right sizing of power generation equipment for deploying and deployed units based on conditions on the ground.

Principles of a THPS

Tailored Hybrid Power Systems must meet five key principles that help ensure success for the soldier, marine, sailor, or airman in the energy-constrained environment of ongoing and future operations. These principles are scalability, modularity, mobility, autonomy, and reliability.

The U.S. military's manual for joint operations describes an environment "characterized by uncertainty, complexity, and rapid change" with our fighting forces engaged "in a wide variety of activities, tasks, missions, and operations that vary in purpose, scale, risk, and combat intensity." The warfighter is expected to operate across the full spectrum of METT-TC conditions, from the most austere to the more robust, on desert or tropical terrain, and as part of small self-sustaining teams or much larger formations. A THPS must meet five key principles that help ensure success for the soldier, marine, sailor, or airman in the energy-constrained environment of ongoing and future operations. These principles are scalability, modularity, mobility, autonomy, and reliability. Figure 1 is a schematic representation of an E2E deployed hybrid power system that has demonstrated tremendous and immediate benefit to the Warfighter because its system architecture adheres to the five key principles required of a THPS. Hybrid power systems contains Power Generation, Energy Storage, and Power Management components. Power Generation components include fossil fuel generators and renewable power sources. Energy Storage is essentially a battery bank. Power Management components can include a Power Management Module, Power Distribution Module, and Solar Charge Controllers. THPS Power Management components should allow for "smart" system operation.[8]

[7] Dennis Moran, "The DoD's New Competitive Environment," C4ISR & Networks. December 9, 2013.

[8] The AMMTIAC-WSTIAC Journal, Volume 2, Number 1, provides a summary of the "smart" hybrid system. Stikopedia (www.solarstik.com/stikopedia) provides more detailed information.

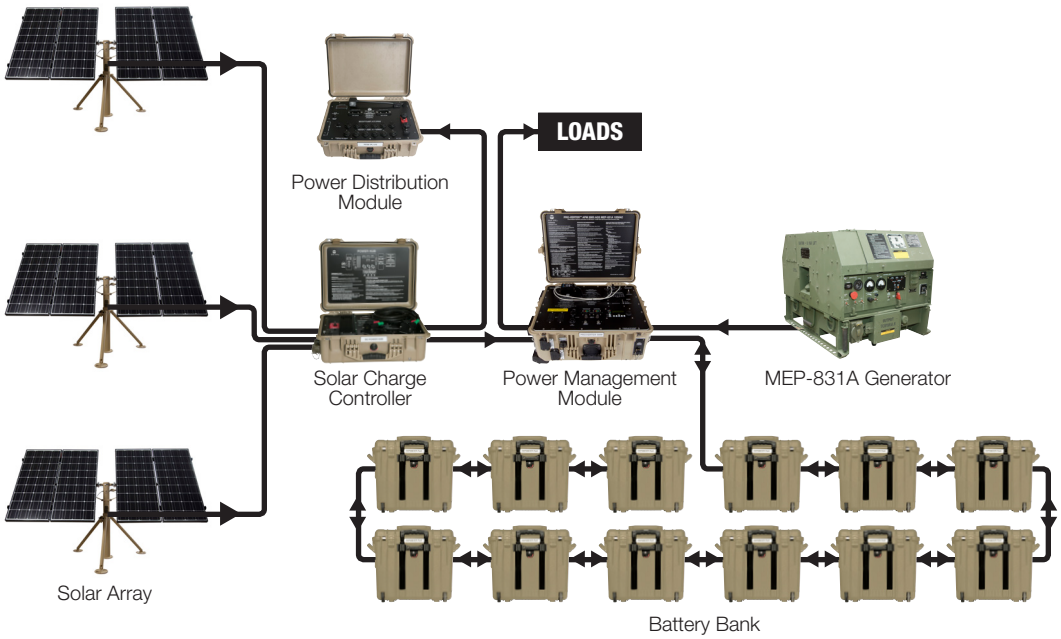

Figure 1 - E2E deployed Hybrid Power System

Scalability

The Hybrid Power System depicted in Figure 1 can be expanded or contracted based on application and requirements. Adding or subtracting components is enabled by Plug & Play operation. An additional 3.0 kW Tactical Quiet Generator (TQG) can be "stacked" to the existing generator to double the power output. More batteries can be daisy-chained for additional energy storage.

The initial entry phase of an operation might only allow for the hybrid configuration depicted in Figure 2, which still provides significantly more operational endurance than deploying with just the small tactical generator. The battery-based, power-on-demand THPS architecture supplies the load with only the exact amount of power required and only when needed. Generator runtime and fuel consumption are reduced because the generator comes on only when the batteries are not able to support the load. The TQG also operates at maximum utilization because all power produced is for immediate load consumption or stored in the batteries for later use.

The Warfighter can later expand the equipment set to the configuration depicted in Figure 3 if necessary, as the situation on the ground clarifies. System components can be added or removed based on application or load requirements. The generator can even be removed in situations when solar power generated is sufficient to support the load and keep the batteries charged. A THPS can easily be scaled to support continuous load requirements and the initial or intermittent peak loads.

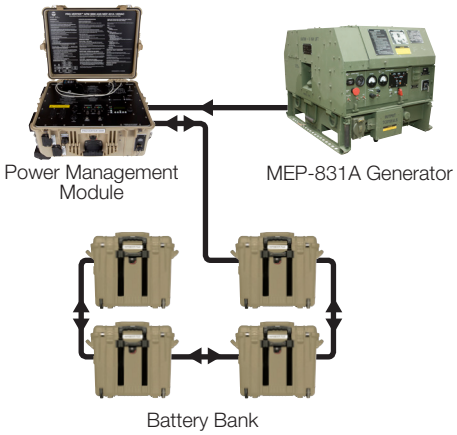

Figure 2 - Example of Hybrid System for Initial Entry Operations

The battery-based, power-on-demand THPS architecture supplies the load with only the exact amount of power required and only when needed.

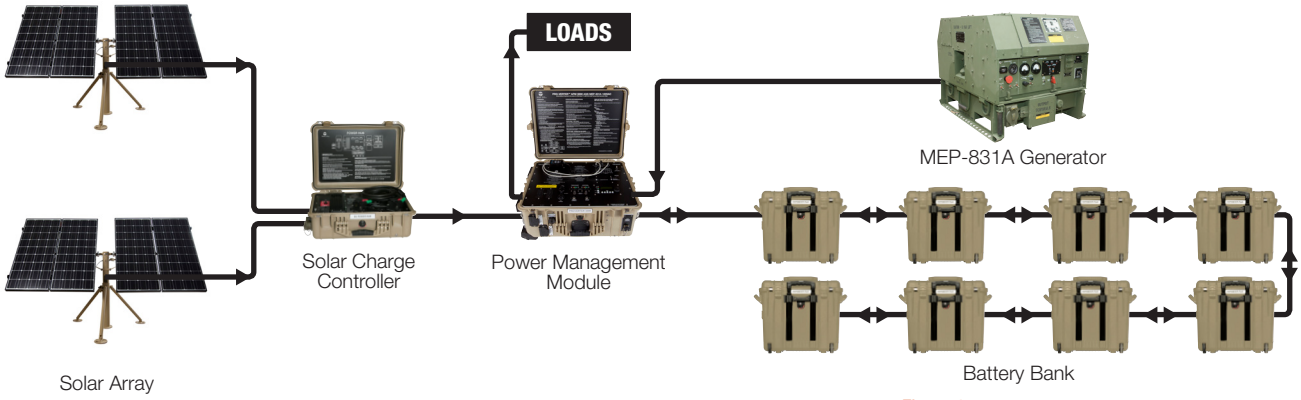

Figure 3 - Example of Hybrid System for Follow-on Operations

Modularity

A THPS should have an open architecture that allows for the integration of existing and future technologies of varying types and different sources. This would provide the Warfighter the greatest operational flexibility. Figure 4 illustrates the concept of modularity. The type of solar panel in the system can be based on the situation or what is available. The THPS should be able to harvest energy from any solar panels, either the ones already in DoD's inventory, or newer versions from future procurement. The MAGTF Commander might find that the greater man-portability provided by a solar array utilizing RolaTube technology is best for the current mission.[9] On the other hand, the Commander for a Brigade Combat Team (BCT) with a static power requirement might opt for a solar array utilizing Solar Stik technology that allows for two axes of panel rotation for maximum power generation.[10] The Warfighter should also have the option to generate power from wind or another renewable source if the situation permits. The type and size of the generator in the system can also vary. The THPS should also be able to incorporate different types of battery chemistries. The best tailored hybrid power solution for an arid environment in the African continent is not necessarily the best tailored hybrid power solution for a tropical region in the Pacific Rim. The key to the THPS is a Power Management Module that can integrate various components with little to no manipulation.

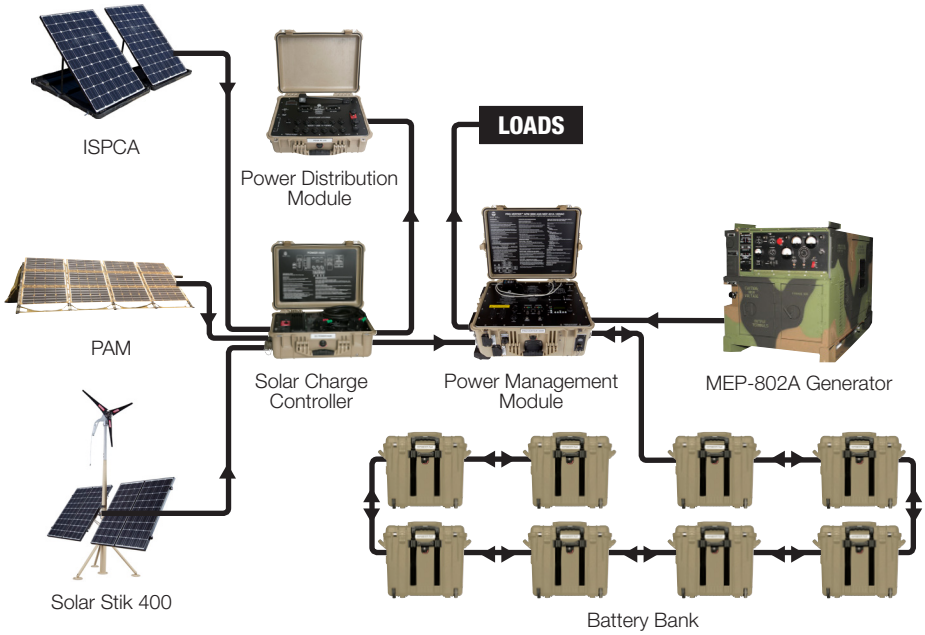

Figure 4 - Hybrid System depicting multiple power sources

The buildup of forces associated with sustained combat or stability operations will likely lead to the arrival of Prime Power capability. The modularity and scalability features of the THPS allows for its use as backup power to critical Mission Command platforms or to meet spot generation requirements once displaced by Prime Power or Host Nation grid.

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[9] The PAM Expedition panels provide roll-up deployment of the system, enabling a lighter and more compact form factor. (RolaTube Technology, 2013).

[10] Adjustment of the vertical and horizontal axes three times a day maximizes sun exposure. Adjustment is made by moving a pin and can be done in less than a minute. (Stikopedia, 2016).

Mobility

A THPS should enable the Warfighter the flexibility to tailor an expeditionary power solution based on transportation requirements. Initial entry or the early stages of a quick reaction engagement have smaller power requirements but would also have limited transportation support. An airborne or air assault operation might initially be supported by flexible solar panels as opposed to rigid panels. Follow-on forces will likely have the capability to deploy with a trailer-mounted hybrid power system.

Autonomy

A THPS should have the capability to harvest energy from any source available whether renewable, vehicular, grid, or traditional generators. Solar is the most prevalent renewable energy source but is not consistently available. The Commander might deem it best to use the Host Nation grid as the primary source but would require a THPS solution for backup power. The THPS incorporates multiple power systems to form a single power source. Power Generation, Energy Storage, and Power Management components work in concert to ensure the most operationally effective source is used first. This would provide the Warfighter a highly robust uninterrupted power supply (UPS) and enable self-sufficiency.

A THPS would typically prioritize the use of renewable energy first over fossil fuel generators, thus reducing both fuel and generator maintenance requirements. The THPS effectively reduces the requirement for fuel handlers and generator mechanics on the battlefield, as well as additional personnel to support and protect them. This is highly beneficial to our future ground forces, which according to the 2014 QDR “will no longer be sized to conduct large-scale prolonged stability operations.” A THPS helps provide for a joint force that has more teeth and less tail.

The autonomy feature of the THPS best exemplifies the return on investment (ROI) offered by hybrid power systems. The “free energy” from renewable sources accumulated over time is evident and can be calculated, but less obvious is the ROI from eliminating power disruptions to critical systems. The immediate ROI from a life or limb saved because a fuel resupply convoy was not conducted might not be quantifiable, but arguably exists. ROI is also gained from mitigating reputational risks in our security cooperation engagements by reducing the impact to the energy supply of partner nations.

Power Generation, Energy Storage, and Power Management components work in concert to ensure the most operationally effective source is used first. This would provide the Warfighter a highly robust uninterrupted power supply (UPS) and enable self-sufficiency.

Reliability

A THPS should be manufactured of durable components requiring minimum maintenance. It should be designed and built for use in the most extreme conditions: excessive desert heat, salt water, snow, ice, and wind. The THPS inherently enhances the reliability of the generator in the system by extending its operational life as a result of reduced downtime. A THPS also enhances the reliability of the sensitive electronic equipment it powers by eliminating power surges.

A THPS should have a Power Management Module that can adapt to the fast pace of hybrid power system technology. The Power Management Module should be "smart" enough to incorporate past, present, and future technologies with minimum or no modifications.

Tiered Procurement Concept for the THPS

Renewable power systems are expensive and DoD can't afford to allocate the equipment for a hybrid power system to every authorized diesel generator. Military units will encounter different types of METT-TC conditions. MEHPS should not be restricted to four one-size-fits-all categories with predetermined capabilities. A Marine Infantry Company with a 3.0 kW TQG will have different MEHPS Lightweight considerations than an Army Stryker Infantry Company with its own 3.0 kW TQG. The MEHPS Medium solution for a desert environment will not be the best MEHPS Medium solution for a tropical region. The right answer is a tailored hybrid power solution borne out of energy-informed decisions during mission analysis and operations planning. There should not even be a final solution because the THPS enables on-the-ground adjustments to be made as the situation changes or power requirements are better defined.

Instead of procuring a locked-in MEHPS solution through the traditional POR process, DoD should follow an Agile Acquisition Strategy with less defined parameters. Instead of purchasing set numbers of the final MEHPS Lightweight or MEHPS Medium solutions, DoD should procure increasing and continuously evolving THPS components. Instead of providing an authorized hybrid power system to units, DoD should ensure there are enough THPS components in each installation for units to train on and in prepositioned stocks to draw from in the event of a contingency operation. Intelligence, surveillance, and reconnaissance (ISR) platforms employed remotely and away from the tactical grid should have their own THPS solutions when they arrive in theater and join the fight. The Pentagon codifies the implementation of its Better Buying Power (BBP) initiatives with the recent revision of DoD Instruction (DoDI) 5000.02, DoD's acquisition policy manual. BBP initiatives aim to increase efficiencies in the acquisition process in order to "deliver better value to the taxpayer and Warfighter." The current DoDI 5000.02 emphasizes tailoring and alternative models for how to structure programs.

"I'm trying to make a very big point that there's not just one size or one way to set up a program. There are some basic things that you have to do in almost any program, but beyond that you have to look at the nature of the product and factors like operational urgency ... then lay out a program that makes sense for the product."

- Frank Kendall, U.S. Undersecretary for Defense Acquisition, Technology and Logistics

Intelligence, surveillance, and reconnaissance (ISR) platforms employed remotely and away from the tactical grid should have their own Tailored Hybrid Power System solutions when they arrive in theater and join the fight.

The traditional POR process would typically produce a MEHPS Lightweight with one type of solar panel and likely the same one for MEHPS Medium. An Agile Acquisition Strategy allows for the procurement of more than one type of solar panel. METT-TC should dictate what type of solar panels are employed, or whether they should be employed at all. DoD will likely choose lithium batteries for Energy Storage, but a case can be made that lead-acid batteries are more efficient and cost effective in situations when weight is not a major consideration; why not provide the Warfighter both options? The strategy for developing and procuring a hybrid power system, however, should aim at the development of one Power Management Module that can incorporate different types of renewable and fossil fuel power generating equipment, as well as diverse battery chemistries. This would be an intelligent Power Management Module that includes all the features of the "smart" hybrid power system and supports both legacy equipment and next-generation technologies. The Power Management Module is really the only component besides the traditional generator that needs to be listed in a unit's equipment authorization document.

Military units can have THPS components available to them as Pre-deployment Training Equipment (PDTE). The types and quantity should be based on the likely missions or geographic alignment of the units. A typical PDTE warehouse can have the following THPS components at a minimum:

- Solar array with RolaTube technology for Tier 1 environment and mobile applications
- Solar array with Stik technology for Tier 3 environment and static application
- Flexible solar panels for small teams with small power requirements
- Energy Storage components
- Power Management Module for units that do not have one authorized or on hand
- Generators for units that do not have one authorized or on hand
- Trailer-based hybrid power system

The Warfighter will gain confidence on the effectiveness of his equipment only through proper training. The reduction in fuel consumption enabled by Tailored Hybrid Power System will reduce the frequency of fuel resupply only if the Warfighter is confident of its capability.

Units can train on this equipment on a rotational basis according to their training cycle or higher headquarters' priorities. The Warfighter can gain familiarity with hybrid power systems at a minimum but be fully trained when they need it most. Units can develop techniques, tactics, and procedures (TTP) that maximize the benefits of a THPS. The Warfighter will gain confidence on the effectiveness of his equipment only through proper training. The reduction in fuel consumption enabled by the THPS will reduce the frequency of fuel resupply only if the Warfighter is confident of its capability. The training conducted prior to deployment will result in TTPs with reduced fuel resupply operations. The Warfighter would also be better trained to select the optimum hybrid power configuration for specific METT-TC conditions: a tailored hybrid power system. In the event of a deployment, units can deploy with THPS components from PDTE or draw from pre-positioned stock. Industry can surge production and replenish training stocks for follow-on units or support additional requirements in theater.

Conclusion

The 2014 Quadrennial Defense Review is the latest high-level document to emphasize the importance of Operational Energy considerations and its impact on military capability. DoD must not forget the energy security lessons learned from the past decade-plus of engaging in the Global War on Terrorism. The pace of initiatives advocating for an energy-informed culture in the military must increase and go unimpeded despite budget cuts. The joint Army and Marine Corps effort to develop MEHPS should be given high priority since culture change alone is not sufficient. The Warfighter also needs equipment that can be tailored for requirements generated from energy-informed decisions during mission analysis and operations planning. Tailored hybrid power systems must be scalable, modular, autonomous, mobile, and rugged to be effective.

There is growing call in Congress, the military, and industry for acquisition reform. Today's budget-restrained environment and the rapidly evolving nature of emerging technologies to include hybrid power systems necessitate the increasing use of a more agile acquisition process. The Warfighter currently engaged in operations conducted in austere environments needs hybrid power systems now. Energy and logistics will likely be constrained for the next major combat operation, so the Warfighter must be trained to employ a tailored hybrid power system now. Utilizing Agile Acquisition in the procurement of Tailored Hybrid Power System is the answer that will best serve the United States and its Warfighters.

"We will actively seek innovative approaches to how we fight, how we posture our force, and how we leverage our asymmetric strengths and technological advantages. Innovation is paramount given the increasingly complex warfighting environment we expect to encounter."

- 2014 Quadrennial Defense Review

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