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**FEATURE ARTICLE**

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## Alternative power sources sought for remote bases

By Breanne Wagner



Mobile generators that produce renewable energy are about to be fielded by the Army's Rapid Equipping Force in Iraq and Afghanistan.

Available from commercial suppliers, these technologies not only offer low-cost power, but may also cut the number of petroleum tanker convoys traveling dangerous roads in Southwest Asia.

While hybrid vehicle technology and fuel cell programs are still in research and development, new, more mature programs such as wind and solar powered generators are being touted as quick, mobile power solutions by the Army's Rapid Equipping Force.

U.S. commanders in Iraq have asked the Pentagon to come up with portable renewable energy sources, possibly in the form of

wind turbines and solar power. They are seeking ways to cut back on the number of ground convoys that transport fuel into Iraq.

The director of the Rapid Equipping Force, Col. Greg Tubbs, asked a group of energy experts to find commercial products that can be deployable within 18 months and that will reduce fuel consumption by 40 percent.

"We want to do nothing to diminish mission capability, but rather decrease the fuel need," Dan Nolan, head of the effort at the REF, said at an Institute for Defense and Government Advancement tactical power conference.

The U.S. military relies heavily on fossil fuel. The Defense Energy Supply Center said the military brought in a total of 1.29 million gallons of fuel per day in Iraq. From Kuwait alone, U.S. troops bring in 890,000 gallons of fuel a day across the southern border, Nolan told National Defense.

This massive fuel need became a dangerous liability when insurgents began targeting convoys coming from Kuwait, Jordan and Turkey. The result was an increase in improvised explosive device attacks against them. Attacks were as high as 30 per week.

"There has always been strategic importance on reducing dependence on energy we don't control ... but now there is a tactical importance," Nolan asserted.

The REF task force is focused on developing solutions for forward operating bases, or places where the U.S. military does not plan on having a permanent presence, Nolan said. This created a need to find small, transportable devices.

Skybuilt Power of Arlington, Va., is providing a mobile power station, which has been dubbed the transportable hybrid electric power station. The THEPS uses several different power sources, including a wind turbine, solar panels, a diesel generator and storage batteries. The system's diesel generator uses "as little fuel as possible" while decreasing the logistical tail from fuel run systems, Skybuilt Power CEO Dave Muchow, told National Defense.

THEPS provides, on average, 5 kilowatts of power output, depending on the type of units and the weather conditions, Nolan said.

The system can fit into a standard freight container. Muchow believes that it can "put power closest to the source," he

said. "Mobile power systems can more easily get to remote areas where roads are blocked."

Skybuilt will make two variants for the Army, one mobile power station that can be towed by a humvee, and one tactical operations center that can act as a "manned or unmanned operations center, a medical clinic, small office or sleeping quarters," Muchow said. "It can be heated, air conditioned, outfitted with sensors."

The first THEPS system was scheduled for shipment to REF headquarters at Fort Belvoir, Va. in March, where it was to undergo a 45-day testing schedule. The REF is considering shipping units to Djibouti and Kuwait and then to Iraq and Afghanistan.

A so-called "tactical bio-refinery" is another mobile system being pursued to convert field waste to energy. The system, which is built by Defense Life Sciences, McLean, Va., will convert paper, plastic, cardboard and food slop into bio-fuel gas to power a 60 kilowatt generator, Nolan said. The food waste goes into a bioreactor, where industrial yeast ferments it into ethanol, a "green fuel," according to Purdue University, whose scientists are working with Defense Life Sciences. As an added benefit, the system helps to eliminate much of the waste on the battlefield.

The bio-refinery can save 115 gallons of fuel for every ton of waste converted, Nolan said. The first prototype has already been built and the full system will be ready for demonstration within 12 months, said Jerry Warner, founder of Defense Life Sciences.

On this project, the REF worked with the Defense Advanced Research Projects Agency.

Under a separate effort, DARPA is developing a mobile integrated sustainable energy system, or MISER. The idea is to take packaging materials — not garbage — from the field and convert them to generator fuel, which could eventually be used in a fuel cell.

Packaging materials account for a large amount of field waste — more than seven pounds per day per soldier. DARPA aims to reduce the cost and logistical burden of disposing the plastic packaging by harvesting it for energy.

The high-energy content of the plastic packaging — close to that of diesel fuel — makes it an ideal alternative energy source. "At today's level of packaging being discarded, a military unit could achieve well over 100 percent self-sufficiency for its generator fuel needs," according to a DARPA document.

The REF is also pursuing in-house technologies to solve some of the power issues in the field. One example is the intelligent generator set, which is being developed by the Army's communications-electronics research development and engineering center. It will act as a back-up power source for renewable energy source systems. The small 3 kilowatt tactical quiet generator can power hybrid systems at night or at times when there isn't a lot of wind or sun, said a researcher at the Army Research Development and Engineering Command, who asked not to be identified.

When the Army requires the extra help, the generator will use only 0.4 gallons of fuel per hour when running at full 3 kilowatt power, the researcher added.

The generator will soon "be able to communicate through a central distribution set when to turn on and off," Nolan said. Currently, a soldier has to manually turn a generator on or off, which can waste energy. Plans call for future versions to be able to operate and communicate within an intelligent power distribution set.

Two of these generator sets have been ordered and received. An additional system will be delivered to Fort Belvoir for field support and trouble-shooting purposes, Nolan said.

Other sustainable power solutions such as hybrid electric vehicles and hydrogen fuel cells — two of the most well known and publicized alternative power sources — are still being funded and developed to reduce fuel dependency. Yet the focus has shifted away from these systems.

Col. Don Gibson, director for integration at the Army Research, Development and Engineering Command, found that fuel cells and hybrid electric vehicles may not save the military as much energy as once hoped. Slower development also means that they will not be a viable solution to the urgent fuel convoy problem.

Gibson concluded that fuel cells are "inadequately ruggedized for the military environment," and that "significant fuel savings are not likely."

Fuel cells have also been criticized as being too expensive and too new for military use.

However, fuel cells as part of a hybrid system are considered to be a viable option for the future. Gibson believes that fuel cells will first be used in small, portable systems.

Hybrid electric vehicles are also touted as an innovative power solution, but development has slowed in recent years as a result of the complexity of adapting the technology to the rugged military environment. While the commercial market has made great strides in development of hybrid vehicles, it's not so easy for the military.

Gibson said that "fuel savings are unproven" in hybrid electric military vehicles. These vehicles also require extensive military driving cycles and scenarios "to facilitate efficient and reliable system design with reasonable and predictable life."

There is still a lot of work to be done if these vehicles are to become a viable alternative power source. Analysts estimate that at the earliest, military hybrid vehicles could enter production in 2010.

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