



Alternative fuels power next wave of equipment

By Chris Harrison

Nobody has a bigger, looser budget than they did a few years ago. Turf managers need to cut costs everywhere they can. One of the best places to start might be at the fuel pump out behind the barn. Forget about diesel or gas. Look at equipment that uses other fuels.

This is not blue sky. Some of the technology is already in use at places like Niagara Falls State Park (NFSP) and on sports fields around the nation. Other technology is a few years out, but test units already are operational.

"There is a big industry demand for more electrification to eliminate hydraulics in both sports turf and golf turf," says Brad Aldridge, product manager for John Deere Golf and Turf. This has to do both with saving fuel and keeping hydraulic fluid leaks from blemishing turf.

"The industry is calling for more in that

area," Aldridge continues. "Colleges and major league fields are looking for perfect turf. Nobody wants to see a fluid leak mar the field."

While products like Bio-HyGard, a biodegradable hydraulic fluid, have been around for years, hybrid technology can greatly reduce the number of places leaks can occur.

When it comes to fuel savings and lower operating cost, Brian Melka, director of product management at Jacobsen says electrically powered or hybrid technology is the way to go. Although most electrics and hybrids are smaller units today, he sees the technology moving up to larger equipment.

"Fuel savings with hybrids are huge," he says. "We typically see a 50% to 70% reduction in fuel consumption."

"In the world of grounds maintenance equipment, electrically powered or hybrid technology will give huge fuel savings," Melka says.

Since the variable cost of operating a machine throughout its productive lifetime will typically exceed the capital cost of purchasing the equipment, it will pay to push a pencil on new equipment.

Fuel cells

The Toro Company is working a partnership with the State of New York to provide the next generation of turf maintenance equipment powered by hydrogen fuel cells. The project, kicked off this winter, supports New York's Executive Order 111 to adopt "Green and Clean" State buildings and vehicles.

"Toro is excited to partner with the State of New York on its initiative to adopt clean-energy technologies," says Dana Lonn, director of Toro's Center for Advanced Turf Technology. "This project is a logical extension of our strategy and ongoing innovation, and provides us with an opportunity to gain greater operational

experience in hydrogen fuel cells.”

Toro will provide NFSP with three hydrogen-powered utility vehicles based on their Workman E-2065 chassis. Turf managers got their first glimpse of the hydrogen-powered Workman at the 2007 Golf Industry Show.

The utility vehicles are used by NFSP and Beaver Island State Park and Golf Course to shuttle workers and grounds equipment, drag infields, haul turf materials, and assist with refuse and snow removal. “Through our partnership with Toro, we will be able to put this exciting fuel cell technology to work,” said Carol Ash, acting commissioner of the New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP). “The use of fuel cell vehicles at these facilities will enhance our operations relating to grounds, turf, and refuse and snow removal, as well as highlight our continuing commitment to supporting sustainable energy and Green Park initiatives throughout our system.”

This is not production-ready equipment, Lonon emphasizes. “It is a technology evaluation and planning exercise,” he says.

Early on they encountered their first glitch: the hydrogen production facility was delayed.

Lonon notes that hydrogen power is an excellent option for government or warehousing applications where a single fueling location can support a fleet, as opposed to the general automotive business where a flock of hydrogen stations would be required to support highly mobile auto users.

Fueling with hydrogen is much like fueling with gas or diesel. A fitting is connected to the port and a gas—rather than a liquid—is pumped into the tank. In about a minute, the vehicle is refueled and ready to go. Compare that to the process of removing and recharging batteries.

In addition, Lonon notes, battery powered vehicles “get wimpy” at the end of a charge. Hydrogen cells simply need to be refueled.

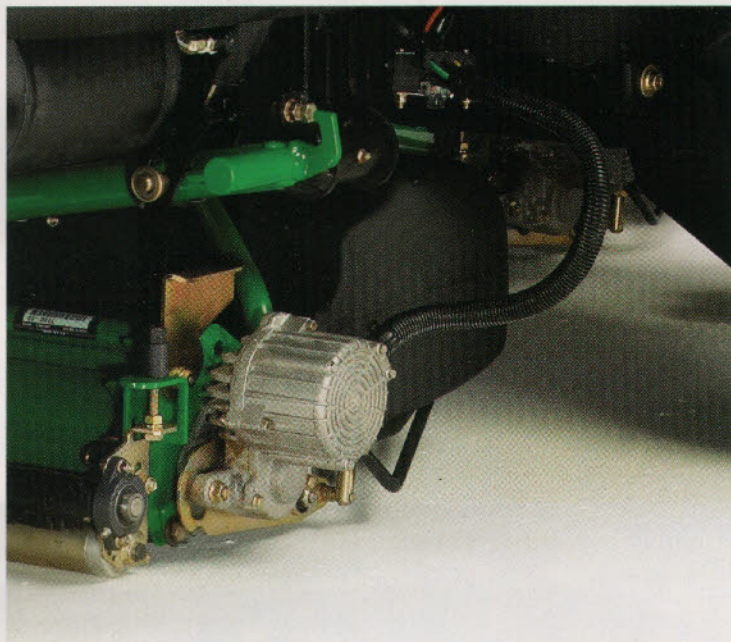
The New York State Energy Research and Development Authority (NYSERDA) is contributing \$380,025 toward the project. In response

to the Executive Order, NYSOPRHP has an aggressive green parks initiative to support the advancement of hydrogen technology in New York.

The NYSERDA-funded project included hydrogen fuel cell vehicles because they generate minimal emissions. Other benefits include reduced noise, increased machine efficiency over gasoline- or diesel-powered equipment; rapid refueling versus recharging of battery-operated equipment; and low emissions (fuel cells emit water vapor as a byproduct).

Lonon notes that sports and government applications of fuel cells are ideal for testing the technology. County park systems, school districts and the like are eager to be good environmental stewards. Often, grant money or dollar-matching is available from states. “It is politically viable to help a government agency (as opposed to a private business),” Lonon notes.

The Niagara Falls project is being evaluated and the prognosis is good. “Hydrogen will be here in the nearer term, not long term,” Lonon says.

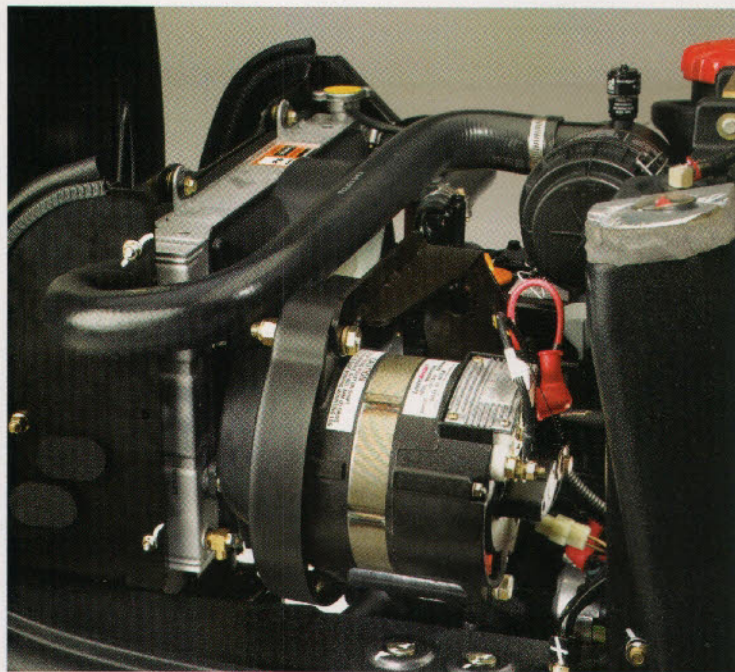


Auto manufacturers

That is because this is not futuristic technology. And it is not just the turf world where alternative power is available. General Motors is rolling out a hydrogen fuel-cell powered fleet of Chevy Equinox vehicles at the New Year. Honda has its own version. BMW's X-6 has two electric motors backing a gas engine and Mercedes has its 450 hybrid that uses lithium-ion batteries. Nissan is working on something called the Mixim, which will use similar batteries with a quick-charge feature.

Lonon notes that the future of battery power is not tied to the auto industry. However, he says the sheer volume of auto production will help drive costs down.

In the groundskeeping world, not all electric innovation comes from the “big name” companies. A Santa Rosa, CA-based firm called The



Electric Vehicle Company is marketing its ZAP Xebra PK all-electric utility truck. "It is the only street-legal electric truck on the market," claims Bob Kopach, vice president of the firm. It has a 110v on-board charger.

The PK costs about three cents a mile to operate and can hit speeds to 40 mph. A three-wheel unit, it has two seats and weighs 1880 pounds. It can carry up to 500 pounds in its bed. The PK, which lists at \$11,750, is a zero-emissions vehicle.

"The bed is configured so it can be used as a pickup truck, a dump truck or a flatbed," Kopach says.

Building biodiesel

Biodiesel is an alternative fuel source derived from biological sources that are completely biodegradable and non-toxic—typically, corn. Emissions from bio-fuels and biodiesel blends are lower than petroleum-based diesel fuels making them more environmentally friendly. There are various levels of biodiesel fuels including B2, B5, B10, B20 and B100. For example, biodiesel fuels designated as B20 represent a mixture of 80 percent petroleum and 20 percent bio-fuel.

John Deere's sports turf and golf equipment currently is approved for B5. Aldridge says they are working on getting B10 and B20 approvals. Like many others in the industry, he cautions turf managers to be sure of the quality of biodiesel coming from their suppliers.

The Toro Company has hopped on the biodiesel bandwagon, stating that all of its diesel-powered sports fields, golf course, and grounds equipment will be "Biodiesel Ready" by this year. The list of equipment this covers includes the Reelmaster, Groundsmaster, Greensmaster, Workman, and MultiPro product families. Beyond these specific product families, Toro will continue to expand the use of biodiesel fuels in other diesel-powered equipment lines.

"Anything we offer in 2008 will be B20 compatible," Lonn says.

"Our biodiesel readiness initiative is part of a commitment to developing innovative solutions that meet the evolving needs of our customers and help to better the environment," says Mike Hoffman, chairman and CEO of Toro.

"The time is right for Toro and the industry to commit to this effort," Hoffman adds.

The company also has upgrade kits for the above-mentioned product families to convert diesel models already in production or in the field to be compatible with biodiesel fuel. "They are simple to install," Lonn notes. The main job is to switch out fuel filters and install fuel lines made with compatible materials.

For the past 5 years, Toro has conducted extensive equipment testing using bio-fuel and biodiesel blends. With kit modifications and an understanding of a few additional precautions customers can enjoy a more efficient, cleaner technology through biodiesel fuel blends of up to B20. "It's a relatively minor job," Lonn adds.

Hybrids

"Hybrids are now cost-effective in our industry," says Aldridge. Deere's 2500E is a Hybrid Riding Greens Mower with a 19-hp diesel

or gas engine. "The engine powers a 48-volt alternator," Aldridge explains.

That alternator drives the reels. For starters, the electric reduces the overall noise level by 3 decibels, significant in many markets. However, there are other benefits, as well.

Reduced noise levels allow for early morning mowing without disturbing folks who may live nearby the facility. This opens up the window of opportunity to get mowing done earlier in the day.

The 2500E runs at half throttle without sacrificing reel speed. This means a high cut quality, but less fuel consumption compared to other systems.

"We see greatly increased fuel efficiency, with savings of up to 30 percent," Aldridge says. With fuel prices hovering around \$3 nation-

Lithium has promise, challenges

Whether for sports turf equipment, computers or automobiles, lithium has the most promise as a battery power source. It is far more energy-dense than lead-acid. But it also has challenges.

"There are charging issues," says Dana Lonn, director of Toro's Center for Advanced Turf Technology. When one leaves a lead-acid battery to charge and it becomes full, it "pushes back" against the charger. Lithium does not do that.

Instead of over-charging, a lithium cell will get hot. Remember the computer laptop recalls due to fire danger? This was precisely the cause.

Lonn says the answer is smarter chargers. "A BMS (battery management system) can make the chargers smarter, allowing them to monitor voltage and cell temperature," he says.

He also would like to see cell volume increase. But the first challenge is to have better management of the charging process.

wide, a 30 percent savings brings the cost of a gallon down to the \$2 range.

There is a quality bonus, too. "About 90 percent of the leaks on reel mowers are at the cutting reel," Aldridge says. While the 2500E still has traction drive and hydraulic lift and lower, the alternator drive cuts the number of hydraulic points dramatically.

"The 2500E eliminates 102 potential hydraulic leak points," Aldridge says.

Even for an operation using biodegradable hydraulic fluids that is a big bonus. Besides, if a typical machine requires hydraulic fluid changes every 200 hours, with biodegradables that interval drops to every 100 hours. There are other savings, too.

TOOLS & EQUIPMENT

"Just in hybrid technology, we see a 50% reduction in horsepower requirements for the same output," Melka says.

The result is a lighter machine to do the same amount of work.

The prototypes of the hybrids of tomorrow are more compact machines than today's gas or diesel models. That is reflected, as well, in the unit's reduced weight.

On top of that, there are significant reductions in the emissions from the vehicles.

"There are reduced parts costs, too," Melka says. The newest designs do not need the additional hydraulic hoses and other fittings that add to the maintenance costs.

"Hybrids are easier to work on, too," he adds.

Plug into electric

At the lower end, electrical mowers already are available for working around buildings and in tight quarters.

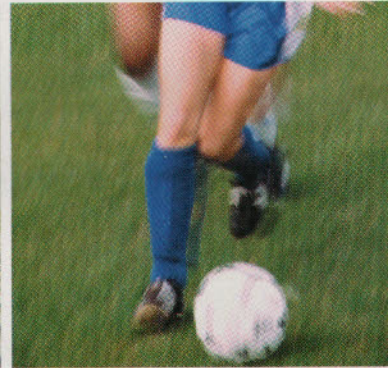
However, the electric mower is not condemned to a 21-inch pusher. Most manufacturers are well along in their plans to come out with big electrics.

The first objection most turf managers will raise is to the weight of an electric unit.

"Lead-acid batteries are heavy," Melka concedes. But the latest technology is based on lithium-ion batteries, the same technology typically seen in cellular phones and joggers' personal music devices.

"Lithium ion batteries are scaling up in size. They offer as much as a 75 percent weight savings over the old lead-acid batteries for the same output," Melka says. That last part—about having the same power output—is a key.

In addition, the cost of the lithium ion batteries is coming down fast



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TOOLS & EQUIPMENT

as the technology is adopted, the size of the units it can power increase, and the places where it finds applications broaden.

"The cost is coming down rapidly," Melka says, adding that he expects to see broad lithium ion adoption in larger mowers in about three years.

Deere offers an electric Gator with eight 6-volt batteries. While batteries are okay in utility vehicles and run-arounds, there is a downside in using them in mowers. In addition to the potential for compaction, battery-run vehicles slow down as they lose charge—get wimpy, as Lonon noted. Reels are not turning as fast at the end of the day as they are at the start. "That's why we chose to go hybrid with our mowers," Aldridge says. ■

Chris Harrison is a veteran free lance writer with experience in the turf industry.

Cool technology for cleaner cuts

There is some neat, new equipment that will appeal to anyone with upper-end turf maintenance needs, too. John Deere's 2500E Hybrid Riding Greens Mower provides the ultimate combination of new technologies. The reels on this unit are powered electrically rather than by traditional hydraulic systems, says Brad Aldridge, product manager, John Deere Golf & Turf One Source.

The system uses a 48-volt alternator driven off of either a gas or diesel engine to distribute power to the reels. The 2500E can be run at half throttle without sacrificing any of its reel speed. This means a high cut quality, but less fuel consumption compared to other systems. The 2500E can save up to 30 percent more fuel than traditional hydraulic machines. Other benefits of the 2500E are reduction of hydraulic leaks and reduced noise levels. With the 2500E, John Deere eliminates 102 potential hydraulic leak points in the reel circuit. This means less opportunity for turf damage due to leaking hydraulic fluid. Reduced noise levels allow for early morning mowing without disturbing folks who may live nearby the facility. This opens up the window of opportunity to get mowing done earlier in the day. Ease of maintenance is key, too. "That's why we have added onboard electrical diagnostics to some of our machines, including the 3245C Independent Deck Mower and the 2653B Trim & Surrounds Mowers," Aldridge continues. "The John Deere WhiteBox controller allows operators and technicians to diagnose problems without even leaving the seat."

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