

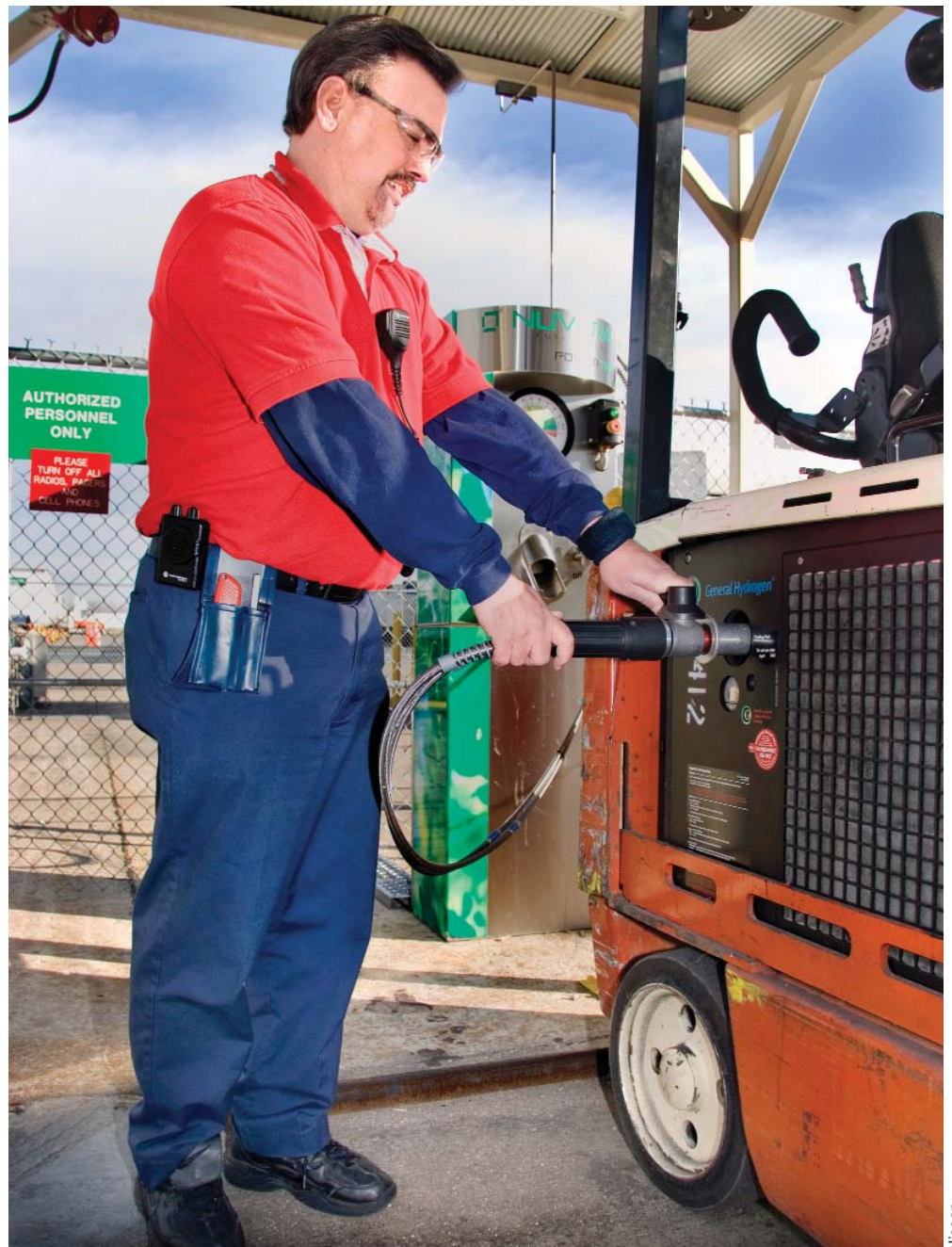
# NISSAN GREEN PROGRAM

**Charging forklift batteries currently consumes 3.2 million kilowatt hours of electricity per year. Switching to hydrogen fuel cells would eliminate 2,098 tons of carbon dioxide emissions.**

**by Vicki Smith**

**A**t Nissan's massive vehicle assembly plant in Smyrna, when the gauge on Dennis Sisco's forklift indicates his equipment is ready for a power boost, the technician drives his forklift to the filling station and fills the tank . . . with *hydrogen*.

Nissan is conducting a trial of forklifts powered by hydrogen fuel cells. Using fuel cells in the industrial equipment market is a fairly new technology developed within the past two years, and Nissan is exploring the benefits the lifts could provide in its material handling



Nissan employee Dennis Sisco pumps hydrogen into the forklift's fuel cell power pack.

Nissan

# RAM TESTS LIFTS



## ZERO-EMISSION HYDROGEN

fleet. Limited one- and two-unit trials have been conducted for periods of three or four weeks over the past two years, with positive results. The Smyrna plant is now employing nine fuel cell forklifts in a five-month trial, and a temporary fueling station has been set just outside its main delivery dock.

“Hydrogen supplied from the hydrogen tank is fed into the fuel cell, where it generates electricity, which is used on demand by the forklift,” said Keith Phillips, engineer, Lean Manufacturing. “Generated electricity is supplied to the motor to spin the front wheels. The only byproducts are heat and water. Some of the water is reused within the system, and the rest evaporates. There’s no carbon dioxide and no carbon monoxide. Hydrogen is a clean fuel.”

The fuel cell power system used in the Smyrna forklifts is supplied by a Canadian-based company that specializes in fuel cell power systems and fueling stations for industrial vehicles and other off-road equipment. Although the hydrogen fuel cell pack is user-friendly, Nissan engineers are working with the vendor to recommend changes to improve performance.

This real-world trial, which began in May 2007, is closely supported by Nissan’s Industrial Machinery Division and the Nissan Research Center, both based in Japan. Nissan started its development of fuel cell technology in 1996. Research and development efforts on a variety of technologies—from fuel cells and hybrid vehicles to electric and compressed natural gas vehicles—are ongoing.

### Hydrogen Fuel Cell Benefits

Fuel cell forklifts offer many benefits over traditional lead-acid battery-powered forklifts.

- **Environmental benefit.** Hydrogen fuel cell packs do not emit pollutants. Because the technology is environmentally friendly, the U.S. government has offered a 30 percent energy tax credit on the cost of fuel cells in 2006 and 2007. Charging forklift batteries consumes 3.2 million kilowatt hours of electricity per year. Switching to hydrogen fuel cells would eliminate 2,098 tons of carbon dioxide emissions, in keeping with the Nissan Green Program, the environmental plan for Nissan’s global operations.

- **No recharging of lead-acid batteries.** Nissan stores more than 1,000 batteries in charging racks to supply its fleet of 340 forklifts/tugs. The racks take up much-needed floor space—13,000 square feet in Smyrna’s three charging areas—that could be used for other purposes.
- **No disposal of lead-acid batteries.** This is also better for the environment.
- **Longer life.** A hydrogen fuel cell pack can last 10 to 12 years versus up to five years for a lead-acid battery, and maintenance costs are expected to be lower for the packs.
- **Faster refueling.** The hydrogen fueling station is easy to operate. Filling the fuel cell pack takes only two to five minutes. Changing a battery takes seven minutes, and recharging and cooling it takes approximately 16 hours.
- **Extended run-time between fills.** A completely filled hydrogen fuel cell forklift can run for about 18 hours while the plant is in full production. A battery-powered forklift runs for approximately four to six hours before the battery must be recharged.
- **Consistent and better power.** As a lead-acid battery loses power, the forklift slows down. There is no slowdown with the hydrogen fuel cell. The forklift operates at 100 percent power all the time, and drivers can refill the unit whenever they want.

During the trial, Nissan forklift operators make thorough notes in the log notebook attached to each unit. They measure fuel fills, record the time between fill-ups and any maintenance issues, and make other notes related to performance. Data collected during the trial will be analyzed both by the vendor and by Nissan.

Fuel cell forklifts may be new in the 24-year-old Smyrna plant, but the employees who drive them give them high marks.

“We love them,” says Dennis Sisco. “The performance is great, and you don’t have to worry about recharging once or twice a shift. These units are simple to operate, easy to refill, and, best of all, good for the environment.” ■

*Vicki Smith is the senior manager of Corporate Communications for Nissan North America, Inc., in Smyrna, Tennessee.*