Firms try ammonia as juice for pumps

By **LEN RICHARDSON**

Key Points

- Two firms are working on the world's first ammonia-fueled irrigation pump.
- The pump is being built to meet new 2010 emissions rules.
- Ammonia contains more hydrogen than liquid H_2.

SAWTELLE & Rosprim Inc. ("Sawtelle") of Corcoran, Calif., will work with Hydrogen Engine Center Inc. of Algona, Iowa, to design and build the world's first ammonia-fueled irrigation pump system for the purpose of meeting California's new emissions requirements scheduled to go into effect in 2010.

HEC has established an Oxx Power engine lineup capable of running on a multitude of fuels, including hydrogen, making the decision to design ammonia-fueled engines the next logical step. These fuels include but are not limited to: hydrogen, gasoline, propane, natural gas, ethanol and ammonia.

Plans include integrating HEC's ammonia-powered engines with Sawtelle's pump technologies and expertise to complete a prototype system for testing and evaluation. The prototype system is being designed to run 24 hours a day and is expected to be tested in California during the 2007 irrigation season.

HEC intends to begin selling the finalized system during 2008.

"We believe that the demonstration of this engine will complete years of development work and will allow the sale of our systems worldwide without concerns about hydrogen storage, cost, availability or permitting," says Ted Hollinger, HEC president. "With the success of this project, we hope to move ammonia-fueled engines into the market."

By having a broad range of products, along with the ability to work with "both hydrogens," HEC plans to provide engines with substantial power ranges that are environmentally friendly.

NH_3 the other hydrogen

Ammonia (NH_3), also known as anhydrous ammonia, which the agricultural industry has relied on as a fertilizer for many years, contains no carbon, stores like propane and is the second most prevalent chemical in the world.

IRRIGATION INNOVATOR: Sawtelle & Rosprim Inc. is a California-based machine shop that builds pumps and tillage equipment like this large pump used by farmers for irrigation.

Ammonia contains more hydrogen per cubic foot than liquid H_2. Hollinger considers ammonia "the other hydrogen."

An infrastructure for ammonia is already in place, as transporting and storing the fuel is much like that of propane. Usage and safety regulations for ammonia are already in place; therefore, the process of obtaining a permit to use ammonia is usually relatively simple.

Ammonia pipelines can be found in many areas of the United States and distribution of the fuel has already been established.

■ **To reach Sawtelle & Rosprim, visit *www.sawtellerosprim.com* or call (559) 992-2117. For more, visit *www.hydrogenenginecenter.com* or call (515) 295-3178.**

UCLA improves RO filters

By **MELISSA ABRAHAM**

RESEARCHERS at the UCLA have developed a new reverse osmosis, or RO, membrane that promises to reduce the cost of seawater desalination and wastewater reclamation.

Reverse osmosis desalination uses extremely high pressure to force saline or polluted waters through the pores of a semi-permeable membrane. Water molecules under pressure pass through these pores, but salt ions and other impurities cannot, resulting in highly purified water.

The new membrane, developed by civil and environmental engineering assistant professor Eric Hoek and his research team, uses a uniquely cross-linked matrix of polymers and engineered nanoparticles designed to draw in water ions but repel nearly all contaminants. These new membranes are structured at the nanoscale (the width of human hair is approximately 100,000 nanometers) to create molecular tunnels through which water flows more easily than contaminants.

More energy efficient

Unlike the current class of commercial RO membranes, which simply filter water through a dense polymer film, Hoek's membrane contains specially synthesized nanoparticles dispersed throughout the polymer — known as a nanocomposite material.

"The nanoparticles are designed to attract water and are highly porous, soaking up water like a sponge, while repelling dissolved salts and other impurities," Hoek says. "The water-loving nanoparticles embedded in our membrane also repel organics and bacteria, which tend to clog up conventional membranes over time."

INNOVATION: Eric Hoek holds a vial of nanoparticles and a piece of his new water filtration membrane.

With these improvements, less energy is needed to pump water through the membranes. Because they repel particles that might ordinarily stick to the surface, the new membranes foul more slowly than conventional ones. The result is a water purification process that is just as effective as current methods but more energy efficient and potentially much less expensive. Initial tests show new membranes consume 50% less energy.

A critical limitation of current RO membranes is that they are easily fouled; bacteria and other particles build up on the surface and clog it. This fouling results in higher energy demands on the pumping system and leads to costly cleanup and replacement of membranes. Viable alternative desalination technologies are few, though population growth, overconsumption and pollution of the available fresh water supply make desalination and water reuse ever more attractive alternatives.

Abraham is with UCLA news service.