



bridge over troubled water

There is a reason output from Canada's oilsands is on the verge of becoming the nation's number one source of oil production.

Having succeeded in making economic the once horrendously costly process of extracting oil from northern Alberta's oilsands, scientific innovation is now taking the next big step — making it increasingly environmentally friendly. Now, a new kid on the block is out to bring its patented technical know-how to the oilpatch as part of that trend.

Previously a Kelowna, B.C. company focused on municipal wastewater treatment, Aqua-Pure Ventures Inc. has moved to Calgary and is in the midst of adapting its proven technology to the oilpatch. In the burgeoning oilsands sector, the company sees an opportunity to tap into a water-purification market it expects will grow in value to a half-billion dollars.

According to FirstEnergy Capital Corp., the oilsands sector could add more than 1.8 million bbls of oil production a day to today's output by decade's end, accounting for a startling 75% of overall Canadian oil production compared to just 35% today. By then, in-situ production alone will suck back close to 100 million litres of water a day. Aqua-Pure, whose innovative technologies were a perfect fit for the industry's steam-assisted gravity drainage (SAGD) water purification needs, was quick to see its opportunity.

By its very nature, the SAGD oil recovery technique is dependent upon large volumes of water. The process involves the injection of produced steam down a horizontal well into a heavy oil or bitumen deposit to decrease the oil's viscosity, increasing the flow into a second, parallel well from which it is pumped to the surface. Water and oil are then separated, and the wastewater is purified to industrial standard for reuse.

The beauty of Aqua-Pure's purification system lies in its simplicity, its size and its ability to feed almost entirely off waste heat. The company has fine-tuned what is probably nature's most prevalent means of purifying water — distillation — with a few innovations to make its units energy efficient and easily transportable, and therefore economic.

"There are some big companies that make gigantic field-erected evaporators. What separates Aqua-Pure from conventional evaporation technology is that our system is compact and is skid-mounted, unlike our competitors which are all field erected," says Mike Sadler, Aqua-Pure's director of business development. "What that means for a northern Alberta climate is, because it's skid-mounted, it is very easy and inexpensive to install. The benefits are pretty substantial in terms of the savings on field installations. That's really the big driver."

Self-contained, modular units reduce costs, time to install and the amount of plot space required for water treatment, Sadler adds. Rather than use a traditional shell and tube distillation design, Aqua-Pure has developed its proprietary Compact Rising Film Evaporator.

It uses a plate and frame heat exchanger design that is simple to retrofit, or to expand by simply adding more plates. The system's higher heat transfer coefficients reduce the heat exchanger size. And ground-level access makes for easy maintenance.

By replacing chemical-based water-purification systems that now dominate the industry, Aqua-Pure says it can not only reduce unwanted discharges that are typically landfilled, but can reduce water demands and maintenance time. The system concentrates contaminants into a blowdown stream that can be disposed of or processed further to provide zero liquid discharge by reducing the entire liquid stream in a crystallizer to solid form.

The main drawback of evaporation and condensing, recognized as the method that can handle the greatest variety of dissolved solid contaminants, has been the high latent heat requirement for the phase change from water to steam. If it wasn't for the cost of energy required to distill water, the method would be used to a much greater extent, according to the company.

Aqua-Pure's evaporation process makes use of low-pressure steam or compression for heat input. And it uses state-of-the-art heat exchange technology provided by Alfa Laval, with whom Aqua-Pure has entered into a

strategic alliance, to complete a system it calls the most effective single treatment for removal of dissolved solids and recovery of industrial grade distilled water.

In its initial venture, Aqua-Pure teamed up with Alberta Energy Company Ltd. In a combined project, for which the companies have applied for a combined patent, the pair married Aqua-Pure's distillation technology with a waste heat power source produced at AEC's Foster Creek pilot SAGD project.

Using heat produced in the thermal recovery process that was previously released to the atmosphere, the plant produces boiler feed water from oilfield produced water without pretreatment with a net energy cost approaching zero. "We are taking that waste heat, where there is no other use for it, and we are turning it into a useful source to recover water," Sadler says.

The self-contained modular unit in operation since November is fully automated, which dramatically reduces daily operating requirements when compared to other systems and permits remote operation and monitoring, notes Sadler. And so far, its operators are impressed.

"It's extremely simple to operate. There are a couple of small pumps and that's about it. It's just slicker than heck," says AEC SAGD



Assembly of Aqua-Pure's compact and skid-mounted purification system.

production superintendent Mike Wasyluk, who likes its low-maintenance nature. "There are no chemicals, no regeneration and the flows can vary up and down like you wouldn't believe — it doesn't really affect it. It just idles up and idles down, all automatically. And it makes very good quality water as well. When you look at the quality of the water that comes off of a hot or warm lime system,

Gas Storage Simplified

Distillation Adds Life To Subterranean Salt Dome Storage Sites

Heavy oil isn't the only market niche staring Aqua-Pure in the face as it readies to turn the corner from a research focus to profitability. The developer of a cost-effective distillation purification process for oilsands extraction facilities sees a second oilpatch niche in the treatment of salt water that is integral to the storage of natural gas liquids in underground salt caverns.

Caverns in salt formations are a common storage vehicle for liquefied natural gas. NGL is pumped into the storage caverns in the summer when demand is low, displacing brine (very salty water) in the cavern. In winter, the brine is pumped back in, displacing the NGL that is then sent to market.

The Achilles heel of the technique has been the storage and maintenance of the brine outside of the cavern in the summer. Typically stored in large open surface ponds, it is susceptible to dilution due to rainwater. If pumped back in the cavern, the less salty water eats away at the cavern's walls with each cycle until it compromises the integrity of the cavern itself. Additionally, the operator is left with excess salt water on the surface, which creates a disposal problem.

One solution is to cover the ponds. But that could cost several million dollars and lead to costly ongoing maintenance bills. Enter

Aqua-Pure's distillation technology, which can be installed at less cost and provide a long-term solution. The evaporator units can be used to bring the diluted brine back to near saturation. The remaining distilled, salt-free water can then be put to use elsewhere, such as in a facility's cooling towers.

Aqua-Pure has already sold one brine concentrator unit to BP Canada Energy Company for use at its NGL fractionation terminal at Sarnia, Ontario, making it the first in the industry to successfully use the technique.

"They are just in the startup phase right now," says Mike Sadler, Aqua-Pure director of business development. He says the market is a growing one, though it will never rival the size of the heavy oil recovery sector's water purification needs. "There are a lot of players out there with these underground salt domes and sooner or later they all run into the same scenario."

Alberta Energy Company Ltd., with whom Aqua-Pure has already partnered in the sale of its first evaporator unit to the heavy oil sector, is one such potential customer. Not only was it a pioneer in NGL storage, but it announced recently a move to extend the concept to the storage of crude oil in deep salt caverns at Foster Creek. The unique venture is expected to result in the creation of storage capacity of 1.4 million bbls of oil by as early as this fall. —M.S.

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where you have to put it through further treatment and the whole nine yards, this is very simple in comparison.”

AEC is also pleased with the reduced waste stream Aqua-Pure can provide. “With a warm lime system, you’ve got a whole pile of sludge that you’ve got to get rid of. This system concentrates the blowdown — which is like all the hardness you have in the bottom of your kettle — so now you’ve just got a concentrated liquid blowdown that you can dispose of in a disposal hole. With sludge you can’t do that. It’s got to be landfilled.”

The technology arrived too late for full implementation into AEC’s nearly complete commercial-scale Foster Creek SAGD project. But Wasylyk says it is being actively considered for future production. “We are looking at the economics of how this system could be employed in future phases or expansions of our first phase,” he notes. “They’ve got a couple of different ways of generating the heat for making the system work, so it looks pretty diversified. It certainly has its place.”

As water conservation becomes even more crucial, Wasylyk says the system could find even more uses. “When you can’t get into a place where they have good water, for exam-

ple, brackish water and things of that nature can be used very simply with this system.”

AEC SAGD operator Rick Getz says the use of waste heat is key to the system’s economics. “If you have a waste heat source, then you can capitalize on that energy. Now if you have to create heat to run the unit, then you would have to look at the economics of that versus a hot lime softener’s economics. But if you have a waste heat source, then you can capitalize on that energy.

“The energy is coming from the steam condensate that we don’t use in our wells,” he explains. “The steam quality through our steam flood boilers is 80% quality. Our (SAGD) technology requires we use 100% quality in our wells, so to get that 80% up to 100% we dump that 20% condensate out and that raises up your quality to 100%. That 20% quality that we are dumping out is the heat that we are capitalizing on for Aqua-Pure.”

As the list of producers to have announced their own plans to enter into in-situ oilsands extraction mounts, interest in Aqua-Pure’s technology has exploded. Building on its success with AEC, the company is in discussions with numerous potential buyers for deals worth more than \$120 million. “I don’t think there is a sin-

gle company we haven’t been talking with,” says Sadler. “Just about everybody involved in water treatment in the oil industry has either been up to Foster Creek and kicked the tires on our unit or they have been in very close contact with personnel there.

“There are a lot of people that are very keenly watching AEC because AEC is way out in front (in commercial SAGD production),” Sadler adds. “The oil industry tends to follow one another when something has been proven.”

— *Maurice Smith (E-mail comments to NewTechnology@smenergy.com)* ■