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PROCESS INSTRUMENTATION

Corn for cars: **sustainability initiatives in ethanol production**

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How do Kawartha Ethanol's production processes contribute to a greener globe? Three areas: reduction in water usage, heat reclamation, and energy savings.

Along the way, Siemens instrumentation and control system play a significant role in these sustainability solutions.

Pull in to many gas stations and you'll notice the word "ethanol" greeting you at the pump. Ethanol is an alcohol made from renewable resources such as corn and wheat. Most major petroleum companies offer gasoline with a blend of ethanol – in fact, during 2011, global ethanol production exceeded 84,000 megaliters (22.3 billion gallons) [US Department of Energy].

Benefits of ethanol include a reduction of our dependence on fossil fuels, decreased toxic tailpipe emissions, and a sustainable energy source that is truly 'green.'

The sustainability surge

The concept of sustainability has been around for decades, but is just now start-

ing to be felt on a large scale. Companies like Siemens are showing that environmentally friendly and economically sound are not mutually exclusive.

Siemens products and services have created substantial reductions in greenhouse gas emissions for the company's customers. In 2011, Siemens helped its customers reduce annual CO₂ emissions by about 320 million tons – an amount equal to the total annual CO₂ emissions of Berlin, Delhi, Hong Kong, Istanbul, London, New York, Singapore, and Tokyo combined! [Siemens Sustainability Report 2011]

With all of the media discussions about green business, sustainable initiatives and the like, it can be difficult to decipher how these issues reach you and your commu-



SITRANS LVL200 vibrating point level switches give reliable backup overflow protection on Kawartha Ethanol's chemical dosing tanks.



Workers load waiting trucks with distillers grains, a solid material co-product from the ethanol production process, destined for cattle feed.

nity. Are there any sustainable business practices happening in your village, town, or city? For many people, the answer is a resounding yes!

Take Havelock, Ontario, Canada for example. This small central-eastern Ontario community is home to Kawartha Ethanol, one of Canada's mid-sized ethanol producers. Kawartha Ethanol began operations in 2010, and has a production capacity of up to 80 million liters of fuel-grade ethanol a year – that's more than 1.4 million (average-sized) vehicle gas tanks! Throughout production, the company's aim is to operate in the most sustainable way possible. How the company brings sustainable business to small-town Ontario is a story that both Kawartha Ethanol and Siemens are proud to tell.

From grain to "greener" gasoline

Ethanol production involves processing grains, combining them with enzymes, and then distilling this "mash" to produce a high-quality alcohol. Fuel grade ethanol is 99% pure alcohol and has a number of important properties to make it an excellent automotive additive. It is clean burning and has a high percentage of oxygen (35%), which encourages more efficient combustion of fuel. Used in vehicles, ethanol decreases carbon monoxide emissions by up to 30% [Canadian Renewable Fuels Association (CRFA)]. Ethanol is not in itself a complete solution to global warming, but with 88.6 million barrels of oil globally consumed on average each day every day [International Energy Agency, 2012], this type of GHG reduction is an important step on the path to sustainability.

So how do Kawartha Ethanol's production processes contribute to a greener globe? These processes primarily involve three areas: reduction in water usage, heat

reclamation, and energy savings. Along the way, Siemens instrumentation, weighing and analytical devices play a significant role in these sustainability solutions.

Solutions snapshot: water usage reductions

While a single barrel of crude oil takes 1851 gallons of fresh water to produce, most ethanol plants can reuse about one third of their total water consumed [CRFA]. At Kawartha Ethanol, plant designers have gone above and beyond in their water reuse initiatives.

The plant has four containment areas surrounding its chemical storage vessels and another two surrounding its fuel storage tanks. These concrete barriers prevent chemicals from leaching into groundwater in the event of a spill. Since these areas are outside, naturally they collect any rainwater that might fall during a storm, but none of this water goes to waste. Pumps move rainwater back into the ethanol process, into the stage where corn is mixed with water to make a slurry. Reusing this water in the containment areas is a water-saving solution unique to Kawartha Ethanol – and an effective one at that.

In the event of a spill, costly cleanup may be required, as the spill could possibly damage equipment. As well, if a spill occurred in the containment area, any water that had been gathered would be contaminated and may become unusable for the mixing stage of the ethanol process. Kawartha Ethanol has a number of safety measures to prevent spills in these areas.

The plant uses Siemens SITRANS P DS III digital pressure transmitter for continuous level monitoring on its chemical storage vessels. These transmitters monitor the hydrostatic pressure in the vessels and convert the measurements to level readings.



SITRANS P pressure transmitters are mounted on pipes to monitor steam in the plant.



Kawartha Ethanol uses extra wraps of removable, customized insulation to reduce heat loss in crucial areas.

They offer comprehensive diagnostics and high reliability, ensuring that operators have consistently accurate level measurements. SITRANS LVL200 vibrating point level switches are used as backup for the facility's continuous devices, providing overflow protection for the chemical vessels and throughout the production process. These point level switches have reliable performance and feature a robust design to prevent failure in aggressive applications such as this.

To monitor recirculated water, as well as other material moving from process to process, Kawartha Ethanol uses a number of flowmeters from Siemens. For measuring liquid flow, SITRANS F M MAG 5100 W sensor combined with SITRANS F M MAG 6000 transmitter have a measurement accuracy of $\pm 0.25\%$, giving operators high performance and maximum functionality.

Solutions snapshot: heat reclamation

During the manufacturing process, temperature and pressure control is crucial to ensuring a quality final product and a safe working environment. The measurement required most in plants during ethanol production is temperature.

Kawartha Ethanol uses product-to-product heat exchangers to redistribute different temperatures throughout the plant. Heat exchangers circulate high-temperature liquids or slurries with low-temperature ones – without mixing these materials.

Where are these heat exchangers used in the facility?
Three examples:

- The stage where enzymes break down the corn mash into simple sugars creates a great deal of heat. The mash

must be cooled from 85 °C to 41 °C (185 °F to 106 °F) before moving to the fermentation stage. Cooling waters circulate to lower mash temperatures into the optimal range. This process can reclaim over 40 °C (104 °F) without using extra energy to cool the mash.

- After distillation, the corn slurry (stillage) is separated into cake and liquid using centrifuges. The liquid is concentrated through a series of evaporators which use waste heat from distillation. The two products are then combined to form a bright yellow, high-protein mixture. This co-product of ethanol production is then sold as distillers grains for animal feed.
- Instead of using energy to heat process water for use during ethanol production, heat exchangers circulate water with flash steam. Flash steam is created in the boiler condensate system where liquid moves from a high pressure to lower pressure areas.

Siemens temperature and pressure instruments play an important role in heat reclamation. SITRANS T temperature transmitters monitor the mash cooler, making sure that the slurry enters the fermentation stage at the correct temperature. The pressure created during the ethanol process also needs to be closely monitored. SITRANS P pressure transmitters measure areas such as the boiler condensate system. Too much pressure can be dangerous, so these devices are accurate with advanced diagnostics and safety functions. Valve positioners from Siemens accompany all of the temperature and pressure transmitters in the facility. SIPART PS2 valve positioners are flexible devices for all of these applications and provide intelligent diagnostics.



Dozens of Siemens flowmeters measure water, chemical dosing, and material flow throughout the ethanol production.

Solutions snapshot: energy savings

Another initiative plant designers use at Kawartha Ethanol involves making sure every bit of heat is not lost in transport. Customized insulation wraps are secured around pipes and vessels containing heated material. If operators ever needed access to instruments, they could easily unwrap the insulation, perform whatever maintenance is needed, and then rewrap it.

All of the process instruments monitoring these pipes and vessels are connected through a Profibus network, sending information to a SIMATIC PCS 7 system from Siemens. In the control room, operators can tell immediately if a piece of equipment requires maintenance and they can respond quickly. SIMATIC PCS 7 provides high-performance engineering tools, with features such as alarm management, process safety, and asset management. As Bill Harris, Electrical Supervisor at Kawartha Ethanol sums up, "Our process includes hundreds of Siemens instruments, measuring flow, level, pressure, and temperature. All feeding back to a centralized DCS system via a Profibus network. We rely on the accuracy and dependability of this system to ensure we operate efficiently and safely."

Siemens for sustainability

*"Leave the world better than you found it; take no more than you need; try not to harm the environment; make amends if you do."*¹

Written two decades ago, these words echo the drive behind the sustainability initiatives currently in place at Kawartha Ethanol. If anything, the need for greener practices in industry has only increased these past two decades, and will not soon disappear. Siemens process instruments play an important role in helping companies



All instruments are linked via a Profibus network, feeding directly into the SIMATIC PCS 7 system for convenient monitoring in the control room.

like Kawartha Ethanol operate their plant efficiently – by providing operators with precise process information.

Recently named one of Canada's Greenest Employers for 2012, Siemens Canada demonstrates that its products as well as its corporate values are in tune with sustainable practices. Striving to 'leave the world better than they found it', Kawartha Ethanol and Siemens prove that green business is indeed possible, both in small towns and on a global scale.

¹ Paul Hawken, *The Ecology of Commerce: A Declaration of Sustainability*, Harper Collins, 1993.

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