TREATMENT PLANT OPERATOR
tpo™
DEDICATED TO WASTEWATER & WATER TREATMENT PROFES
tpomag.com
AUGUST 2018

IN MY WORDS:
Education at AlexRenew begins in the lobby
PAGE 20

HEARTS AND MINDS:
Kids' books tell the stories of water
PAGE 18

LET'S BE CLEAR:
Show us your welcome sign
PAGE 8

Travis Medina
Operations Manager
Fort Wayne, Ind.

'Every Day Is *Earth Day*'

FORT WAYNE TURNS BIOSOLIDS AND WATER PLANT LIME RESIDUALS INTO BENEFICIAL PRODUCTS
PAGE 32

contents

August 2018

on the cover

The Fort Wayne Biosolids Handling Facility converts solids from the Fort Wayne Water Pollution Control Plant and the city's Three Rivers Water Filtration Plant into products farmers and city residents can use to enhance their soils. "Our motto is, 'Every day is Earth Day,'" says Brian Robinson, biosolids facility superintendent. "We try to live by that."

top performers:

coming next month: September 2018

FOCUS:
Digital Technology/WEFTEC Pre-Show Issue

- Let's Be Clear: Safety is boring. Or is it?
- Top Performers:
  - Water/Wastewater Operator: Chris Patterson, Jacksonville, Alabama
  - Water Plant: Island Water Treatment Plant in Sanibel, Florida
  - Wastewater Operators: Trailblazing women in Richmond, Virginia
  - Wastewater Biosolids: Fort Wayne (Indiana) Biosolids Handling Facility
- How We Do It: The value of a mock storm drill
- Sustainable Operations: Fast payback on cogeneration in Fort Worth, Texas
- In My Words: BAYWORK looks to fill the career pipeline
- PlantScapes: Educational fence line exhibits in Alexandria, Virginia
- Hearts and Minds: Model Water Tower Competition for Florida students
- Technology Deep Dive: A new approach to tank, basin and digester mixing

The Lebanon Gasification Initiative converts wastewater biosolids and wood waste into electricity, reducing greenhouse gases and the amount of material sent to landfill.

To Boldly Go...

THE LEBANON GASIFICATION INITIATIVE BREAKS NEW GROUND IN RECOVERING RESOURCES AND DRIVING A TREATMENT PLANT TOWARD SELF-SUFFICIENCY IN RENEWABLE ENERGY

STORY: **Ted J. Rulseh**
PHOTOGRAPHY: **Martin Cherry**

IT STARTED WITH A LANDFILL RUNNING OUT OF space and on borrowed time. It ended with an energy plant that each year diverts an amount of landfill waste equivalent to the cargo in a line of semi-trucks 4 miles long.

In the bargain, the plant produces one-third of a wastewater treatment plant's electricity and yields 1.6 tons per day of biochar, a product with commercial value as a farm soil amendment and for other purposes. It's also clean, producing air emissions similar to those of natural gas and eliminating annual carbon emissions equivalent to taking 450 cars off the road.

That's the Lebanon (Tennessee) Gasification Initiative, in operation since October 2016. The gasification plant consumes dewatered biosolids, shredded tires, and wood chips made from recycled pallets and shipping crates, totaling 32 tons per day. An array of 3,192 solar panels adds a megawatt of power generation capacity for the wastewater treatment plant.

Scott McRae, project manager for the City of Lebanon, credits the project's success to a public-private partnership involving Aries Clean Energy, provider of the gasification technology, and Rockwood Recycling, which produces the wood and tire chips that feed the facility, which ranks as the world's largest downdraft gasifier. "It's been like *Star Trek*," McRae says. "We're going into frontiers never before seen."

RUNNING OUT OF ROOM

The wastewater treatment plant wasn't the driver behind the gasification project. Lebanon, a growing community of nearly 33,000 about 30 miles east of Nashville, already produced Class A biosolids in an autoheated thermophilic aerobic digestion, or ATAD, process and applied the material to cropland.

"Landfills are filling up, and many rapidly developing cities like Lebanon are having that problem," McRae says. "Our landfill had eight years left. Our city was searching for alternative ways to manage waste."

City officials looked at various energy plant designs, some that looked good on paper but were not commercially proven, others with excessive operating costs. Aries Clean Energy proposed a technology already in use in Covington, half an hour northeast of Memphis. Lebanon officials paid a visit, liked what they saw, and found the Aries Clean Energy team credible. They signed a contract with Aries Clean Energy and broke ground for the gasification plant in October 2015. The city then hired McRae, to manage installation, operations and logistics.

PROCESSING BIOSOLIDS

The gasification facility stands on the site of the Lebanon Wastewater Treatment Plant (10 mgd design/6 mgd average flow), which discharges to

The wood is shredded by a contractor and delivered to the gasification facility.

the Cumberland River. The facility uses an extended aeration activated sludge process.

Waste activated sludge passes through a rotary drum thickener (Hycor) that yields material at 5 to 6 percent solids. It then enters the ATAD process, after which it is further dewatered in a centrifuge (Andritz Separation), yielding a dry product with the appearance of coffee grounds, according to Billy Dranes, treatment plant manager.

As of late 2017, about 10 percent of that material was being mixed with tires and wood chips and fed to the gasifier; the balance was still being land-applied. The ultimate goal is to gasify all the biosolids; the amount is being ramped up gradually as the process is fine-tuned. "Once we're able to feed all the biosolids to the gasifier, we will shut the ATAD down," Dranes says. "I'm interested in saving money. The treatment plant has about a $50,000 monthly electric bill, and the ATAD accounts for about one-third of that."

Scott McRae, project manager, is pleased with Lebanon's success in finding waste management alternatives.

Shutting down the ATAD will save about $250,000 per year on electricity. "Our city leaders deserve a lot of credit for taking on this project," Dranes says. "It's quite innovative."

FINDING THE WOOD

The key challenge in bringing the gasifier project to fruition was procuring the primary fuel. "Within the first few weeks of the project, I knew we needed 15 truckloads of wood a day," says McRae, who came to his role with experience in the corporate and nonprofit worlds. "You want to talk about some sleepless nights wondering where that volume would come from?"

The original plan was to use wood chips from tree trimmings, but that source was seasonal and not reliable. Instead, McRae focused on discarded pallets and shipping containers, then being landfilled. The city struck an agreement in which Rockwood purchased a grinder and delivers the chipped wood to the gasifier. Lebanon representatives then approached community businesses, chiefly automotive manufacturers and suppliers, offering to take their pallets for about the same cost as landfilling.

"Our proposal was, 'You send them to us, we'll grind them up, and you'll get some green credit for it,'" says Lincoln Young, director at Rockwood. "They loved it. By the time we got to the second or third door, we didn't have to walk in with any explanation. The word had already spread. We had a 44-mile radius circled on the map showing how far we could go to collect the wood economically. We drew a new circle at 22 miles because the response was so great." Rockwood also collects and grinds the discarded tires. "This project created a recycling option right here in Lebanon that did not previously exist," Young adds.

INSIDE THE GASIFIER

Gasifier fuel is delivered in trucks and unloaded into two storage containers that can hold a 1.5-day supply of feedstock. The material is fed into the gasifier where it is thermochemically broken down. "At the belly of the beast, it's about 1,800 degrees F," McRae says. "There is no flame. We pump in oxygen at a rate 75 percent below the value required for ignition. The oxygen catalyzes superheat, but not fire."

Under the intense heat, the wood chips (roughly 2-inch cubes) are converted into a gas that is released and is burned in a thermal oxidizer. The hot combustion gases then pass across a heat exchanger to heat water. In turn, this water enters three 140 kW organic Rankine cycle units. By way of another heat exchanger, the water vaporizes industrial Freon, which then spins turbines to produce electricity.

(continued)

> "Within the first few weeks of the project, I knew we needed 15 truckloads of wood a day. You want to talk about some sleepless nights wondering where that volume would come from?"
> **SCOTT McRAE**

HONORS GALORE

The Lebanon (Tennessee) Gasification Initiative is accumulating enough awards to fill an office wall. Tennessee Gov. Bill Haslam recognized it with a 2016 Governor's Environmental Stewardship Award for Energy and Renewable Resources. The initiative was named the Top Project of 2017 in the Environmental Leader Product and Project Awards.

The facility also won Project of the Year honors from the Tennessee Chapter of the American Public Works Association for outstanding planning, construction and management. With that came nomination for the National American Public Works Association Top Ten Projects of the Year.

In addition, the initiative has received a Project of the Year accolade from *Industrial Wastewater Digest* and a Local Government Award for Public Works & Utility Infrastructure from the Greater Nashville Regional Council.

by the numbers

Lebanon (Tennessee) Gasification Initiative

16,000,000: Pounds of waste diverted annually from landfill
312: Homes that could be supplied by the gasification plant's electricity
32: Tons of wood, tires and biosolids fed to the gasifier daily
450: Equivalent of cars' emissions eliminated
1.6: Tons of biochar produced daily
3,192: Solar panels on the wastewater treatment plant property

The entire gasification and power production process is highly automated. McRae serves as chief operator, and wastewater treatment plant team members Jesse Gilliam and Don Wheeler share time rounding out the operations team.

REAPING THE REWARDS

The gasification initiative removes some 16 million pounds of waste from the landfill, helping to extend its life. The process consistently generates more than 300 kW of electricity and at times operates at the full 420 kW capacity. It fulfills about a third of the wastewater treatment plant's power needs; the shutdown of the ATAD process will reduce the treatment plant's power demand by one-third.

"The solar panels will take care of another third of the plant's electrical consumption," McRae says. "On a good sunny day, we should be turning the electric meter backward."

Mayor Bernie Ash adds, "With the completion of the solar panel installation at the wastewater treatment plant, this facility is in a unique position when compared to other cities our size. The leaders of this city don't just talk about being green. We've actually taken huge steps to increase green energy generation."

And the green energy quest isn't over. "This is part of a bigger vision for the future," McRae says. "Now that we've proven the technology, as a next step I would love to see three or four of these units in a chain reaction, where we would take all our municipal solid waste, dump it into a sorting station, remove the glass and metals, pelletize the remainder, and then gasify it to make more electricity and more biochar, and eliminate more waste going to landfills. Pretty much anything that can be consumed in a fire can be gasified — even food waste, once you eliminate the moisture content."

It's a vision Lebanon and its residents can carry into the future. tpo

The majority of the wood waste used in the gasification facility comes from used pallets, a more reliable source than tree trimmings.

SITTING ON TREASURE

The byproduct of Lebanon's gasification process in Tennessee is a commodity with potentially high value — environmental and economic.

The gasification step reduces wood chips to biochar particles, about the size of a pencil eraser, containing about 68 percent carbon and various plant nutrients, and with excellent capacity to absorb and hold water. For the time being, Scott McRae, project manager, has chosen to store the biochar while he seeks to extract the highest possible market price for it.

"Biochar has value," McRae says. "On the West Coast, people scoop it up. Here, we have to build the market. One possible route is to sell to a nearby incinerator, but the operator would expect both a low price and a long-term supply contract. In terms of revenue, the farming community is much more promising."

The material can help farm soil retain moisture and provide slow nutrient release to sustain crops through dry spells. However, at present, local farmers are skeptical: "They would take it if we gave it to them."

In response, he's working on two research projects with the University of Tennessee to generate hard data showing that biochar can reduce commercial fertilizer costs, improve crop yields, and enable crops to germinate earlier. Biochar can also be used as floor covering in commercial-scale chicken houses to absorb airborne ammonia, reducing the need for ventilation and helping keep the chickens healthy.

The project's high-volume biochar production presents a challenge in finding enough users, but for now, McRae is being patient: "There's no harm in storing it for now. We need to get the market jump-started because there is a lot of revenue potential."