Natural Resources Research Institute
University of Minnesota Duluth
Driven to Discover

NRRI *Now*

Monthly Edition November 2017 Issue 11, Volume 2

NRRI Mission:

Deliver research solutions to balance our economy, resources and environment for resilient communities.

www.nrri.umn.edu

From the Editor:

Forest fires are destructive and deadly, as we know from California's recent experience. They're also expensive. In Minnesota, the DNR spent $24.5 million in 2016 on wildfire protection and response.

Perhaps there's something more we can do. Maybe we can harvest those forest fire fuels -- underutilized softwoods and beetle-killed trees -- and find high value uses for them. NRRI research is working to expand uses of excess wood resources and other available biomass.

In this issue, learn about our progress in developing solid fuel with biomass, and a biofuel success story.

But a Blue Ribbon Commission investigating the state of today's traditional forest industries are finding a lack of innovation. Read how NRRI is bucking that trend on our website under News & Events: NRRI innovates Minnesota forest industries.

Stay in touch!

June Breneman

Forest fires burned more than a million acres in California in 2017 according to the CA Dept. of Forestry and Fire Protection.

Duluth Labs & Administration
5013 Miller Trunk Highway
Duluth, Minn., 55811
218-788-2694

Iron Range Labs
One Gayley Avenue
Coleraine, Minn., 55722
218-667-4201

Innovative Research: Renewable Energy Lab delivers!

After 10 years of research, NRRI delivered solid results this fall. As in solid biofuels. By the ton.

Starting at the bench scale in 2003 and fiddling with mixture after mixture, NRRI is now able to produce solid biofuels that perform at comparable energy values to coal in fossil coal-burning facilities. The biofuel emissions have no heavy metal pollutants and greatly reduced sulfur levels. As an added benefit, the biomass feedstock can be invasive plants, woody and agricultural waste, secondary wood species, and beetle-killed wood resources.

NRRI envisions this to be a supplement to fossil coal that helps reduce harmful coal emissions to meet state and federal mandates while minimizing new capital requirements at existing power and industrial plants.

"What's really exciting, and what we've been working so hard on, is being able to produce this product at a commercially-relevant scale," said Don Fosnacht, NRRI initiative director for Renewable Energy. "We had to find a way to make it physically robust and water-resistant for easy shipping and handling, and scale it up to 6 tons per day output. It wasn't easy."

The United States is moving away from fossil fuels – Oregon is the first state to aim for coal-free power by 2020 – but the transition will be slow. NRRI helped to monitor a significant trial of solid biofuel at a Portland electric plant in 2017. They completely replaced the fossil coal with 3,500 tons of biofuel with only minor mechanical changes. This trial demonstrated that this similar biofuel provides roughly 2,500 BTU per pound increase over typical output for Powder River Basin coals.

NRRI's large scale testing facility for biofuel development is producing 4—6 tons per day.

The biofuel can be made with two processes: Torrefaction (a dry roasting method) or Hydrothermal Carbonization (a pressure cooking method). NRRI's large scale rotary kiln is best for roasting wood chips to make solid fuels. The second reactor is like a large pressure cooker that can take other plant biomass (milfoil, invasive cattails and agricultural waste) to make an "energy mud" that is formed into solid fuels.

"If you think about how Mother Nature made fossil coal, it's time, pressure and heat," explained NRRI Engineer Tim Hagen. "We're doing those same processes, but instead of millions of years, we're doing it in a few hours. And because minerals don't get into the mix, we don't have those potential pollutants."

And while this is exciting progress, NRRI is already gearing up for the next steps of biofuel development. Using a high pressure gasification process on the solid fuels, they hope to demonstrate the conversion of the solid biofuel into a synthetic natural gas (sometimes called "syngas"). Other products would be high value chemicals, liquid fuels and activated carbon.

NRRI's renewable energy research was funded by a grant from Xcel Energy, Minnesota Next Generation Energy Board/MN Dept. of Agriculture, Minnesota Power, Heetway, K.R.Komarek, Inc. and the Consortium for Advanced Wood to Energy Solutions.

Minnesota Value: Manufacturer turns waste to biofuel

Quiet Cohasset, Minn., is in the heart of a tamarack bog. Lonza, Inc. -- a supplier of pharmaceutical and biotechnology specialty ingredients -- relies on tamarack wood for its products.

There's a special chemical in the wood of this tree, also known as the Eastern Larch, called arabinogalactan. Its healing properties are used in a variety of dietary supplement and food applications, but also as an emulsifier, a base ingredient in personal care products. The large Swiss company provides 14 people jobs in its Cohasset plant, operating 24 hours-per-day.

But when it became necessary to move wood chips around the plant site, it created a lot of wood dust, or fines. Could NRRI help the facility come up with a way to reduce the dust problem?

First they had to separate the fines from the wood chips. NRRI Scientist Tim Hagen helped the company find the right screening technology to do the job.

"But then we had two piles of materials," said Lonza Site Manager Todd Jaranson. "We had to come up with a market for the fines."

Hagen, who had long been developing a briquetting system for biomass resources, helped them with a densification process for the tamarack particles. They conducted trials at NRRI's lab in Coleraine and demonstrated they could produce a biofuel with some market value. But the value did not justify the equipment cost needed for producing, storing and loading briquettes. Especially with the added trucking cost needed to get the fuel to the customer's location.

NRRI scientist Tim Hagen looks into Lonza's fully operational biomass boiler system.

Another option that Lonza considered was simply loading the fines directly into trailers and selling as is. But the business that wanted the fines was 65 miles away.

"They basically offered to cover the cost of shipping, but we would never get a return on our investment in the loading equipment," said Jaranson.

So Hagen suggested they supplement their natural gas fuel source with their own 200 HP biomass boiler system. It was the option with the most expensive upfront cost, but with potential for recovery of the capital investment in about five years.

Jaranson said the boiler is working great and the whole project helps Lonza meet its sustainability mission. Being able to test the briquetting technology at NRRI's pilot plant proved out the process before an investment was made, reducing risk to the company. Hagen also pointed the company toward Department of Energy grant funds to move the project along.

"This is a great example of taking advantage of the low hanging fruit," said Hagen. "Their fuel source was already paid for and literally lying on the floor of their plant."