

# Will wood help fill US energy needs?

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**F**orget corn processing. Don't wait for switch grass. The real key to producing enough ethanol for America's cars and trucks this century is wood.

That's the contention of researchers at the State University of New York (SUNY). By revamping the way paper is made, they've found an economical way to extract important energy-rich sugars from the trees and then convert these sugars into ethanol, a gasoline additive, and other useful chemicals.

It's a process the researchers call a biorefinery. Installed at the nation's paper mills, biorefineries could produce 2.4 billion gallons of ethanol a year, they estimate, or 80 percent of the nation's projected need this year.

"We know our sources of fossil fuel aren't going to last forever," says Thomas Amidon, a professor at SUNY's College of Environmental Science and Forestry. "Biorefineries allow us to substitute a sustainable energy source: wood."

While the major component of hardwood trees is cellulose, from which paper is made, the second largest component is the sugar xylan. "Hardwoods contain about 35 percent xylan, while northern softwoods contain 9 to 14 percent," notes Dr. Amidon.

Currently, xylan is dissolved during wood processing in paper mills and not utilized. But when it is captured and fermented, xylan produces ethanol, which

can be blended with gasoline. "We also expect to find uses for xylan for controlled release of pesticides and as a thickener," Amidon says.

In his biorefinery, extremely hot, pressurized water flows over a bed of wood chips to separate the cellulose for paper. Then the water is forced through a membrane that removes the sugars and acetic acid. What remains can be burned or gasified for combined heat and power uses.

The fermentation process does not use any harsh chemicals, Amidon notes. "The materials we dissolve in the water are natural to begin with. We know how to clean up water well. When it is clean, its release to the environment has no long-term negative consequences."

The process also produces smaller but valuable amounts of acetic acid. Acetic acid is a key ingredient in making polyvinyl acetate, which is widely used in construction materials. The commercial value of acetic acid is nearly three times that of ethanol: 45 cents per pound compared with 18 cents per pound.

Trees have several advantages over other agricultural products for this process, Amidon adds. Wood is a perennial crop that can be harvested every month of the year. It is relatively dense and slow to decay, which facilitates transporta-



**WOOD CHIPS TO ENERGY:** Energy-rich sugars, trapped in these mounds of chips from a Weyerhaeuser paper mill, can be converted into ethanol and other useful chemicals.

AP/FILE

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tion and storage. Large-scale manufacturing operations need to function year-round to be economic and using wood as the raw material base allows that.

Another potential use of biorefineries is in wood-to-energy power plants. Toward that end, researchers at the SUNY center are developing "biomass willow," a fast-growing shrub that works well in the biorefinery process and takes far less energy to produce than corn does, experts say.

Wood-to-energy plants typically burn wood waste — from logging operations, for example. "One of the biggest challenges we face is locating sufficient quantities of this fuel at prices that allow us to earn a profit," says Lloyd Kolb, chief operating officer of Lyonsdale Biomass LLC. But by using biomass willow and integrating a biorefinery within the operation to capture the valuable sugars, the economics of the business improve, he adds.

Lyonsdale, along with International

Paper in Stamford, Conn., the world's largest paper company, are two corporate supporters of the SUNY center, which is also partnering with New York State and others to further fund demonstration trials to produce ethanol from wood.

"We view this commercial demonstration as the key final step before full-scale development and commercial applications," which might be two years away, says Michael Brower of the SUNY Center for Sustainable and Renewable Energy.

That timetable is reasonable, although International Paper says it has not set a schedule for commercializing the process.

Biorefineries have the potential to double the profits of the paper industry by turning out value-added products while paper mills continue making conventional paper products, according to Masood Akhtar, a council member of TAPPI, a technical association for the pulp and paper industry.