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WOOD

Heating for All?

Why the arrival of European pellet boiler technology on U.S. shores may take **woody biomass** mainstream.

By Dan Bihn

Energy from biomass is receiving renewed attention as a domestic, renewable resource that may help the United States reduce its dependence on fossil fuels. Biomass is even more appealing with the August passage of the landmark Energy Policy Act, which grants tax credits for biomass systems installed in homes and businesses.

The biomass buzz intrigued me. After Googling “biomass energy policy” and further refining the search with “what the heck does this mean to me?” I found that around 80 percent of our biomass energy comes from *woody biomass* (aka wood, bark and branches). That made me wonder how woody biomass might fit into my home, my office and my community. Would our children have to bring lumps of charcoal to school with them? Exactly how would I fit a wood stove into my Dilbertesque office cubicle? And what about smoke and the environmental and health effects?

To get to the bottom of these questions and to find actual examples of woody biomass usage, I set out on a 5,000-mile adventure around the Western United States, visiting schools, forest restoration projects, lumber mills and the occasional karaoke bar. Strangely, all roads led to Europe and some exciting hybrid wood-solar heating technology about to make landfall on U.S. shores. But I’m getting ahead of myself.

Great Potential for Sustainable Heating

To prepare for the adventure, I researched the official energy statistics. According to the U.S. Energy Information Administration (EIA) *Renewable Energy Trends 2004* highlights, 6 percent of U.S. energy consumption came from renewable energy sources last year: biomass, at 2.8 percent; hydro at 2.7 percent; and wind and solar combined comprising around than 0.06 percent. Not only is

our use of biomass expected to increase considerably, but this source already is used more than any other renewable energy source. How can something generating more electricity than all the U.S. dams be so invisible?

It turns out that two-thirds of woody biomass energy actually is wood waste created and consumed behind the fences of lumber and paper mills. This wood waste (primarily in the form of sawdust and something called black liquor) is used for steam heat and electricity for processing wood and paper. Some small portion of the electricity is sold to the electric grid, but most is used onsite at the mill. So even if we significantly increased our usage of paper to generate wood waste, it wouldn’t really reduce our need for fossil fuel.

Finally I found it. It turns out that 12 percent of the energy produced from woody



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Twelve percent of the energy produced from woody biomass, in the form of firewood and wood pellets (shown here), is used to heat houses. Here we find one of the growing segments of U.S. biomass usage — one that could reduce our dependence on fossil fuel.

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Wood Heating

biomass, in the form of firewood (cordwood) and wood pellets, is used to heat houses. Another 2 percent of that generation is used in commercial buildings. Here we find one of the growing segments of U.S. biomass usage — one that indeed could reduce our dependence on fossil fuel. Woody biomass is relatively cheap, carbon-neutral and renewable, can be burned with very low emissions, and is an efficient way to generate heat.

Most U.S. renewable energy policies focus on electricity and transportation, overlooking one of the simplest forms of energy: *heat*. According to the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy, 69 percent of the energy used in our homes is for space heating and hot water — low-grade heat that can be easily and efficiently produced from wood combustion and solar hot water collectors.

Wood can be a sustainable energy source. Wood is considered carbon-neutral; that is, it consumes as much carbon dioxide from the air when it grows as it releases when it is burned. This benefit is increasingly important now that carbon dioxide's role in advancing global climate change has become indisputable. It's also one of the reasons European countries are so interested in promoting energy from biomass. Advanced wood-burning technology also reduces particulates considerably, reducing potential health concerns. Perhaps most appealing is that in many parts of the country, wood fuel is now cheaper than natural gas, and everywhere it is significantly cheaper than heating oil and propane.

As the history of deforestation demonstrates, however, wood is a sustainable fuel only when the harvesting is done in a sustainable manner. Some economic and political groups may use the promise of biomass as an excuse to step up logging in wilderness areas. This process will require vigilance to avoid a scenario in which biomass for the masses becomes a “leave no tree behind” policy.

Until Now, Limited System Options

I was beginning to see how woody biomass might fit into my life.

For home heating, plenty of wood stoves and pellet stoves are available commercially. One of these units can heat your living room or perhaps a small, efficient home, but require a fair amount of effort on your part: buying the wood or pellets, storing it, hauling it to your stove, lighting it, cleaning the ash and periodically calling in the chimney sweep.

At the other end of the size spectrum, when I asked experts about commercial-scale woody biomass systems, everyone suggested I visit Nebraska State University at Chadron. This fall, the university lit its campus-wide heating system for the 15th consecutive year. Ed Hoffman, biomass champion and the current vice president for administration, helped nurture and guide this system from its first day of operation. It heats nearly all of the 5,000-student campus and, depending on how cold the winter is, can easily go through 7,000 tons of locally produced woodchips a sea-



TARM USA INC.



Nichols Hardware in Lyme, N.H., receives a delivery of wood pellets to be used as fuel for its 150,000-Btu-per-hour wood pellet boiler. The building has been heated entirely with biomass fuels for 30 years.

son. Not only does the school save an estimated 30 percent over natural gas, but the money it does spend stays in the community. Hoffman proudly

notes that the children of the family that runs the wood-chipping operations attend his university.

The Biomass Energy Resource Center in Vermont, where 10 percent of public schools are heated with wood, has been guiding the way for schools and community projects nationwide, including the USDA Forest Service-sponsored “Fuels for Schools” program. For centrally heated campuses with cold winters and a nearby source of wood chips, this technology makes solid economic sense.

Those of us stuck in the middle — that is, those of us who don't have a centrally heated campus with immediate access to a forest, or who don't enjoy schlepping 40-pound bags of pellets or bundles of logs through the living room — have been out of luck if we wanted to be part of the biomass revolution. With the arrival of the modern pellet boiler on North American shores, that is about to change!

Something New from Old Europe

In Europe, it's biomass for the masses. Austria, Sweden and Denmark, which each generate more than 20 percent of their energy from renewables, are leading the way in the widespread use of woody biomass heat in ordinary homes and buildings.

Take Austria, for example. In 2001, 21.5 percent of Austria's total primary energy supply, TPES, came from renewable energy sources, compared to our 4.4 percent (data from the International Energy Agency's 2004 Renewable Energy, Market and Policy Trends in IEA Countries). Between 1990 and 2001, solid biomass heat production increased more than sixfold. Nearly all of that growth was in space-heating applications of woody biomass, thanks in large measure to new high-tech wood pellet boilers.

This tremendous growth is no accident. Since the 1970s, Austria's energy policy has focused on developing renewables in

The modern pellet boiler is nothing short of amazing. Several companies are working to bring these systems to the United States — as soon as the 2006 heating season.



DAN BIHN



NORWOOD H. KEENEY/III

Left, insulated hot water pipes await installation/burial for Boulder County, Colo.'s state-of-the-art wood chip-fired district heating system. Right, a delivery truck fills NRG Systems' 30-ton silo with wood pellets. The wind systems manufacturer heats its 46,000-square-foot manufacturing/office building in Vermont entirely with two 150,000-Btu-per-hour wood-pellet boilers.

order to reduce the nation's dependence on imported energy (more than 80 percent of its fossil fuels are imported). The focus on renewable wood fuel was no accident either; 50 percent of Austria is forested. Austria's public investment in renewables focuses on domestic industries and technologies that can create products for export (Germany and Japan are examples of countries with similar policies focused on developing the solar photovoltaic industry). A majority of Austria's government R&D budget for renewables is devoted to biomass, mostly wood.

The modern pellet boiler — typically sized to heat an entire rural home (100,000 British thermal units per hour and up) or small commercial building — is nothing short of amazing. The boiler heats water to about 165 F (74 C) and pumps it through radiators or radiant floors. Ignition and combustion control are controlled by a conventional-looking thermostat — set it and forget it. And these boilers are designed to be an integral part of a solar hot water system, sharing the same plumbing and control systems. The innovation enables a fully modern lifestyle year round, rain or shine, with virtually no fossil fuels.

The boiler itself is impressive, but it is the pellet-handling and -delivery infrastructure that may be credited with propelling wood into the mainstream. Here, pellets are fed automatically to your central boiler from a large pellet storage bin in your basement. It is not uncommon for these bins to be sized to hold an entire heating season's supply (2 to 6 tons).

As for filling that bin, forget about driving your vintage Datsun pickup to the pellet store. You can send a text message from your cell phone to the local energy company to schedule a delivery. A special-purpose tanker-truck with a name like Shell Energy on the side will show up and pump (blow or auger) a few tons of pellets into your bin in just minutes. The wood dust, or "fines," are simultaneously sucked into the truck

to be recycled back into pellets — not into your basement air. It's almost as simple as a fuel oil system on the East Coast or propane system in the Rockies.

Burning wood creates ash (inorganic material in the woody biomass), the amount depending on the type of wood and how much bark is in that wood. Rather than requiring the user to shovel the ash into a bucket, these systems automatically collect and compact the ash for easy removal in something that looks like a briefcase with wheels. Depending on the fuel source and usage, you may need only empty the ash two to three times a season. And you can use that ash in your garden or donate it to the local gardening club.

These systems, sized for homes and small commercial buildings, are not cheap. They can cost twice as much as a fuel oil boiler system — \$10,000 to \$15,000. But the Austrian government helps consumers by paying 30 percent of the premium through tax credits and deductions. The result? In Austria alone, more than 30 manufacturers are duking it

out for their share of this growing market.

Back in the U.S.

Want to try this at home? For the latest in European technology, you will have to wait a year or two. Strong demand throughout Northern Europe is keeping manufacturers too busy to focus beyond. Fortunately, several companies are working to import and certify these products. Alterrus Bioenergy LLC (www.alterrus.com) of Portland, Ore., has partnered with one of Austria's top manufacturers of fully automatic pellet boilers with integrated solar heating controls to bring this technology to our shores. The company aims to have U.S.-certified units ready for the 2006 heating season.

If a pellet boiler without all the fancy features but with all of the craftsmanship meets your needs, you don't have to wait. Tarm USA Inc. (www.woodboilers.com), Lyme, N.H., has been importing a Danish pellet boiler for five years, earning one of the best track records in the business.

In addition to potential state and utility incentives you may be eligible for (see www.dsireusa.org), the feds will grant a tax credit of 30 percent off your home pellet boiler costs, up to \$2,000, and significantly more for a business. The details should be worked out during the next year — just in time for the arrival of the new boilers and another heating season. ●

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