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SPECIAL REPORT

Wood For Energy

Traditional and Emerging Energy Technologies

Fuels For Schools: Lessons Learned

Advice From The Forest Service Manager Who Brought Biomass Heating To Western Institutions

Dave Atkins is a low-key guy with a high-energy job. Since 2001, he's served as the Fuels for Schools Program Manager for the Forest Service's Northern and Intermountain Region.

Together with Forest Service co-workers, RC&Ds, and a team of state coordinators, Dave has helped almost two dozen Western schools convert their heating systems in order to use slash from nearby forests.

Dave Atkins

These days Dave is busier than ever, but he recently took time to discuss some of the hard-won lessons he's learned along the way. He thinks his insights could be valuable to both RC&Ds and conservation districts, both of which he considers to be valuable partners in launching the program into its next phase.

Wood chips from forest fuels reduction projects.

A History Review

The Fuels for School program was started 20 years ago in New England to answer two questions: What to do with the residue from forest thinning and agriculture? And how to help financially-strapped schools with their heating bills? The solution was to use some of that biomass to heat the schools, after first converting, or "retrofitting" their oil, gas or electric heating systems.

The idea was a success, and since 2001, Dave has been directing a three-phase program to transplant it to towns near the forested parts of Montana, Idaho, North Dakota, Utah, and Wyoming.

The first and most heavily funded phase required setting up demonstration projects, the very first of which went online in 2003. Every year since then the Darby, Montana School District has been saving $100,000 on its heating bills.

In the second phase, grants have covered 50% of costs (as opposed to 80% in the first phase) and schools are required to enter competitive applications. This phase is helping to retrofit more than a dozen schools from Kalispell, Montana, to Kellogg, Idaho, and retrofits are also being started or planned for a college, a landfill, a prison, and a medical center.

The program is gaining momentum and is now heading into its third, or "commercialization" phase, in which the Forest Service will continue to lend expertise, but will provide only five percent of the funding.

"Fuels for Schools in the West is shifting from a public to a private focus," says Dave. "And I think that's just the kind of environment that CDs and RC&Ds work best in." So what lessons does he want to share? He's boiled them down to three.

Lesson One: Educate The School Board

Burning wood is always dirty, right?

Wrong. "That's a common misperception," Dave says, "and I've learned to nip it in the bud when I present to school

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Fuel For Thought: America's High-Fiber Energy Future

Ready for this month's energy quiz? Name an energy source that comes out of the ground and can be processed into liquid fuel suitable for transportation.

The answer: Woody biomass. Of course, until now most of us have considered wood's energy uses in a narrower light. Trees and residue get chipped or pellitized for fuel; the fuel gets burned in boilers or stoves for traditional space heating or the generation of electricity; end of story.

But recently a new idea has emerged within the forest industry, starring a concept called "total forest biorefinery." The idea was presented recently in the American Forest and Paper Association's "Agenda 2020" initiative. Basically, the total forest biorefinery involves using existing pulp mills to produce transportation fuels—as well as a myriad of other bio-based products that are currently made using fossil energy sources.

Squeezing Fuel from Wood

Forest biorefineries would use techniques like pyrolosis and gasification to produce synthetic fuels, along with a very clean burning Fischer-Tropsch diesel fuel. In addition, they would use enzymatic processes for ethanol production.

These new fuels are already in the development pipeline. A number of companies recently announced pre-commercial stages of development, and full commercialization of technologies for cellulosic ethanol

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Community College Researches the Power of Biomass

Mt. Wachusett Community College (MWCC) in Gardner, MA and Community Power Corporation (CPC) have collaborated in the development and testing of a bio-powered micro-cooling, heating and power (CHP) system. The program will support the increased awareness of small modular biopower as an energy source by researching the reliability and quality of the cooling, heat, and power produced by the modular biopower system. A communications program is being developed to inform interested parties, receive feedback, and identify the needs and concerns of potential future users of modular biopower systems.

Demonstration of a BioMax biomass powered micro-CHP system at Mt. Wachusett Community College will be a pioneering applied research program. The system, nominally rated at 50 kW will use wood chips as its primary energy source, but it will be fuel flexible, since it will also be able to convert other types of biomass such as switchgrass, pellets, or agricultural byproducts to cooling, heat and power as well.

The micro-CHP system has been provided by CPC, a Colorado corporation involved in the development of small modular biopower systems in collaboration with the National Renewable Energy Laboratory and the US Forest Service. The downdraft gasification technology provides a clean producer gas that powers a General Motors Corporation gasoline engine and generator. The research and demonstration system has been installed on the campus of MWCC. A one-year research and testing program will be implemented by MWCC. The testing program will establish MWCC as a nationally recognized center for applied research in small modular biopower energy generation and application.

The following is a partial list of benefits from application of the BioMax CHP technology:

- Combined cooling, heating and power provides maximum energy savings
- Reduction in emissions such as hydrocarbons, carbon monoxide, oxides of nitrogen and oxides of sulfur compared to conventional fossil fired generators
- No liquid wastes
- Displaces imported fossil fuels
- Fuel flexible, can operate on 100% wood gas or on other sources of biomass to meet the load
- Provides potentially large, new market for unmerchantable small diameter forest thinnings, thereby reducing forest fire danger
- Easy to site and permit
- Can be relocated easily
- On-site modular biopower system interconnected with grid and able to displace natural gas increases energy security for user
- Provides experience base to local utility energy planners and technical staff for evaluating the benefits of modular biopower
- Provides an opportunity for other research organizations to utilize the equipment

The goals of the proposed project address major issues affecting supply of power systems:

- Provide research results on the feasibility of small modular biopower systems to convert biomass to cooling, heating and power
- Assess the technical and economic viability of using modular biopower for micro-CHP application
- Perform an assessment of various prime movers for micro-CHP integration.
- Demonstrate the feasibility of small modular biopower systems to convert biomass to cooling, heat and power
- Improve state and national awareness of modular biopower as a micro-CHP option through the development of an educational outreach program.
- Position MWCC as a nationally recognized center for modular biopower as a micro-CHP

Project objectives follow:

- Perform a one-year research and testing program of small modular micro-CHP
- Demonstrate modular biopower generation of the following: 50 kW electricity, 80 kW heat, and at least 6 tons of thermally activated cooling
- Monitor performance, and measure the amount of electrical, thermal and cooling energy displaced by the micro-CHP system
- Prepare documentation comparing the integration of various prime mover options
- Determine energy conversion efficiencies of the demonstration micro-CHP system
- Proof of concept of the system operation will be established
- Test various biomass feed stocks
- Develop an educational outreach program in conjunction with ongoing projects at the College

Source: Rob Rizzo, Director of Facilities Administration, Mount Wachusett Community College, 978/630-9137 or RRizzo@mwcc.mass.edu.

PSNH Wood-Fired Power Plant in Service

One of the nation's largest new renewable energy projects is now in service in Portsmouth, New Hampshire, producing power to tens of thousands of homes and businesses in the state through the burning of wood chips.

The $75 million "Northern Wood Power Project," located at Public Service of New Hampshire's Schiller Station, has permanently replaced a 50 megawatt coal boiler with a state-of-the-art wood-burning boiler of the same size. As a result, air emissions at the power plant are expected to be reduced by more than 380,000 tons annually through the burning of clean wood chips.

"The dramatic emission reductions from this facility will help us satisfy the strict requirements of the New Hampshire Clean Power Act," noted Gary Long, PSNH president and chief operating officer. "Furthermore, we are able to make this improvement while still maintaining some of the lowest energy rates in the region."

Because it is a new renewable energy project, the PSNH facility will produce more than 300,000 "renewable energy certificates" annually. Revenue from the sale of the certificates to regional energy suppliers seeking to satisfy renewable energy requirements will be used to offset the project's capital costs.

The new boiler is expected to annually consume more than 400,000 tons of wood, most of which will come from suppliers in the Granite State. The use of local wood supply was a key goal of PSNH and the New Hampshire Timberland Owner's Association, an early supporter of the project, and will help bolster the state's economy and advance good forestry practices.

Construction of the Northern Wood Power Project began in October 2004, following a rigorous review by state regulators and by planning boards in Portsmouth and Newington. The project's primary components include a 110-foot high boiler, equivalent to a nine-story building, a wood-fuel delivery system, and a large wood storage facility, capable of holding about 10,000 tons of wood chips.

PSNH currently owns and operates power generating facilities which are capable of collectively producing about 1,100 megawatts of power, and satisfying about 70 percent of typical customer annual energy requirements.

Contact Martin Murray, PSNH Spokesman, at murrame@psnh.com.

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boards."

He begins the re-education process by joking, "This is not your father's wood stove." He explains that high-tech wood-burning systems are much cleaner than coal, and by some criteria are cleaner than fuel oil and propane.

Dave and his associates have accumulated a vast database of emissions-related information. Now they can show that, pound for pound of burned wood, modern boilers release a tiny fraction of the pollutants from slash pile fires.

Dave concedes that compared to natural gas, boilers release slightly higher levels of some pollutants, including carbon dioxide. But he counters that if new trees replace the wood burned in boilers, they'll breath in as much CO2 as was released, and there'll be no net increase in atmospheric carbon dioxide. Fossil fuels, on the other hand, pump "sequestered" carbon into the air and leave it there.

However the clincher for school boards is cost. Dave has developed a series of PowerPoint slides that compare the cost per million BTUs for various energy sources: Fuel oil, $18.00; propane, $16.25; natural gas, $10.50; pellets, $8.00; and wood chips in boilers, a mere $3.75.

But what about all the operators you need? Another non-issue, according to Dave. Licensed operators are required for high-pressure steam systems, but the Fuels for Schools systems run on low-pressure steam or hot water. They don't even require on-site maintenance: Today's computer-controlled, online systems can be monitored by any authorized person with a web browser.

Lesson Two: Build Relationships With Architects

Most school construction starts with a call to the architect, who isn't necessarily aware of biomass. "That's why I had to learn how to get it onto their radar screens," says Dave. He made a point of visiting firms like Montana's CTA, which has since become an advocate for wood heat. (CTA's Nick Salmon recently made a presentation on biomass heat to the Montana chapter of the American Institute of Architects.)

In his soft-spoken way, Dave plans to continue to bend the ears of architects, engineers, and designers. For instance, at a September 2007 biomass workshop in Missoula, he'll conduct a session geared directly to architects. And he's laying the groundwork to be able to provide content for Architecture 2030, a section of the AIA website that addresses the role of architects in reducing greenhouse gas emissions.

Early on, Dave learned an even more important lesson about architects and engineers: Use their time well. "When we started," he says with a pained expression, "we'd pay to have engineers visit the site and assess it suitability. Often, we were spending thousands just to find out that it wasn't going to work."

These days the program starts with a survey that applicants can download from FuelsForSchools.com. Dave explains, "In 20 minutes, we can evaluate it and give them a go/no go decision." If it's a go, engineers visit the worksite, and then Dave presents the client with the estimated cost of conversion and the "payback" period in years. If the client says yes, a state coordinator starts on the nuts and bolts of lining up funds.

Lesson Three: Get The System Up To Size

Burning biomass requires an interconnected system that needs to be big enough to support everyone involved. Dave illustrates this point with his own Tale of Two Cities. "Our demo site in Darby was a technical success," he explains. "But they were only using 700 tons a year, and we realized that's not enough for a wood chip supplier to live on." (It happens that, unlike many other parts of the West, the area has other buyers to help sustain Darby's wood chip contractor.)

Dave figures a supplier needs to be selling at least 10,000 tons of chips a year. "That's the threshold tonnage that makes for a viable business," he points out. And that's exactly what's happening in Chadron, Nebraska, where a three-man business supplies chipped slash for the wood-burning boilers at Chadron State College. The college buys 8,000 tons, but the supplier sells another 2,000 tons to nurseries and farmers.

While Chadron is not in Dave's territory, it holds a lesson for him: Size matters. "To borrow a phrase from mall developers, I'd advise CDs to try to find an 'anchor tenant,' that is, a big 10,000 ton-or-more facility that would encourage other players to jump in." He's hoping that this magnet effect works at one of his newest projects: a 12,000 ton-a-year retrofit for a corrections facility in Carson City, Nevada.

Dave adds that another way to achieve critical mass is to develop multiple facilities, preferably all within a radius of 50 miles or less. And it doesn't hurt for a chip market to be diversified, with other kinds of buyers such as pellet mills, composting operations, and co-generation plants.

It all comes down to infrastructure. "From forest landowners to processors to operators to school administrators, it's like a network," Dave notes. "Its value grows exponentially with each new connection you make—each new person or business."

Passing the Torch to CDs And RC&Ds

According to Fred Deneke, the NACD Forestry Programs Coordinator, "The Forest Service and the Department of Interior are now discussing a possible project that would allow the NACD to take the Fuels for Schools message to Conservation Districts and RC&Ds."

That's good news for Dave Atkins, who thinks CDs and RC&Ds possesss just the expertise and contacts needed to carry his program into its final, market-driven phase. "We're still spreading the news," says Dave. "And the joint agreement would most likely fund a contractor who would advocate for the program at meetings."

Speaking of meetings, Dave will be giving a presentation on Fuels for Schools at the upcoming NACD meeting in Los Angeles on February 7th, 2007.

He's also helping to organize a 3-day workshop in Missoula for the transfer of biomass technology to RC&D and CD managers. The workshop begins September 7th, 2007 and includes hands-on, practical programs: field trips to visit a new company with an innovative system of slash gathering; a panel for operations and maintenance people; a how-to lecture from the plant manager at the University of Idaho; and seminars for architects and engineers.

Dave admits his agenda is ambitious. So what keeps him going? "For one thing, just knowing that we're part of something historic—a paradigm shift from fossil fuels to sustainable fuels."

And maybe that's the secret of his success. Because for Dave Atkins, turning smoky slash piles into heat for school kids is not just a goal. It's a burning desire.

For more information, contact David Atkins at 406-329-3134 or email datkins@fs.fed.us

Source: Craig Rawlings, Smallwood Enterprise Agent, Montana Community Development Corporation.

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and other transportation fuels could arrive within three years. What's more, the potential infrastructure is already in place: Pulp mills that are now closed or underutilized could be retrofitted to produce liquid fuel.

Toting Up the Raw Material

Currently, only about six percent of U.S energy derives from renewables. Half of that six percent comes from co-generation—in other words, forest industries using wood residues and chips as an energy source in their industrial processes.

But if renewables are going to be a viable alternative to fossil fuels, and if biomass is going to be a substantial portion of renewables, then where will all that material come from? A study conducted by the Departments of Agriculture and Energy suggests that 1.3 billion bone dry tons (BDT) a year could be harvested from farms and forests. That's .998 billion BDT from agriculture and .368 billion BDT from forestry sources. To put those numbers in perspective: 1.3 billion BDT would produce the same amount of energy that domestic crude oil produced at its peak in the U.S. in 1970.

The forest-based fuels in this estimate would come from hazardous fuel thinnings, logging and other forest residues. If you added in the 18 billion cubic feet of wood harvested annually in the U.S., that .368 billion figure would skyrocket to almost a billion BDTs. Of course, no one is suggesting a shift from current higher value wood uses to energy; the marketplaces of the future will determine shifts in product and output mixes.

At any rate, a vast amount of woody biomass could also come from short-rotation tree crops. These crops are ready for harvest in three to five years and can grow at the energy equivalent rate of three to 12 barrels of petroleum per acre annually. There is extensive non-forest land, not now in food, feed, or fiber production available in the U.S. for planting of these short rotation trees.

In addition, there is a tremendous volume of woody biomass obtainable through stand improvement work in our nation's hardwood and softwood forests. Demolition wood, construction residues, and urban green waste could be added to the total. Last but not least, the millions of downed trees from Hurricane Katrina could have been salvaged to producing energy.

A Crude Comparison

Unlike fossil fuel, biomass-based fuel is renewable. Once crude oil is pumped, refined, and used, it's gone forever, but trees and crops keep growing back.

Biomass is cleaner, too. When you turn plants into energy, the CO2 released in the process is taken up by the plants that replace them, resulting in zero net carbon emissions. By comparison, burning fossil fuels simply pumps more carbon into an already-overcrowded biosphere.

Just as important, biomass is more reliable. The events of September 11, 2001 alerted many of us to the fact that we pay a costly premium for our dependence on fossil fuels from volatile regions.

In short, energy from biomass helps our planet and our country. But what's in it for forestry? It could mean improved management of nonindustrial forestlands and increased incomes for farmers, forest owners, logging contractors, and forest industries. It could result in new alternative enterprises and enhanced economies for rural areas. (If biorefineries catch on, paper could well become a byproduct of pulp and paper mills.) Finally, biomass energy could mean more productive uses of marginal lands and the resolution of hazardous forest fuels buildups, as well as a boost to the effort to resolve air, water, and soil quality problems.

Support for Wood is Growing

Together with other categories of biomass-based energy, biomass-based fuels seem to have a bright future. After all, they're part of a technology that's reliable, sustainable, and non-polluting, not to mention immune from the shocks of global crisis—all reasons why political support is slowly gaining momentum.

In fact, President Bush mentioned woodchips as a source of energy in his last State of the Union address, and renewable energy is rumored to be a part of his upcoming address. In addition, the Pelosi-led Congress has renewable energy high on its agenda. Some Capitol-watchers are betting that renewable energy evolves into a full-fledged bi-partisan initiative in the current session of Congress.

Gaining Consensus, Moving Forward

Not everyone has signed onto renewable technologies such as biomass-based fuels. What if renewables increase competition (and costs) for raw material supplies? That's still a concern from certain sectors of production agriculture and some forestry industries.

But other industry leaders embrace the idea of a renewable energy future. They see it as the right thing to do for the nation because it's a way to enhance national security, improve the environment, and revitalize rural economies devastated by the forest policies of the past.

The movement is picking up speed, but as with any new technology, entry into the mainstream will be achieved by a combination of private initiative and national political will. The key is to become engaged in the process so that the policies developed through any Congressional legislation are as workable as possible for all.

Source: Fred Deneke, NACD Forestry Programs Coordinator.

Wood For Energy Resources

Here is a list of online resources that are directly involved with woody biomass heating systems, the Fuels for Schools Program, supply, and marketplace communities.

Fuels For Schools Website
www.fuelsforschools.org

Woody Biomass Speakers Bureau
www.forestry.nacdnet.org/SpeakersBureauDirectory.htm

Smallwood Utilization Network
www.smallwoodnews.com

NACD Forest Resource Committee
www.forestry.nacdnet.org

The Marketplace For Forest Resources
www.timberbuysell.com

Log Prices Around The US
www.logprice.com

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