Heating schools with biomass: Fifteen years of success in Vermont

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In the 2001/2001 school year Vermont achieved a singular renewable energy achievement: that year, for the first time in modern history, 10% of the state's public school students attended a wood-heated school. The first of these schools, a small elementary school in a rural area, installed a 0.5 million Btu/hour (145 KW_t) automated wood heating plant in 1986. Since then, twenty-one other schools have installed wood-chip fired boilers, in retrofits and new construction, in small village settings and in large regional high schools and vocational schools. The technology has been slowly spreading to neighboring states, including first-ever biomass plants in high schools in Massachusetts and Maine. A 9 million Btu/hour (2.6 MW_t) central biomass heating plant is planned for a three-school campus in a western Massachusetts public school district.

In Vermont, school wood energy systems burn approximately 7,500 tons of green chipped wood annually, displacing 450,000 gallons of fuel oil. School biomass systems reduce net CO_2 emissions by 4,000 tons and SO_2 emissions by 2,000 pounds annually, compared to the oil they replace. The systems employ tuned, multi-stage firing and computer-controlled fuel and combustion air feed, resulting in two-thirds lower particulate emissions than typical industrial wood boilers. New particulate control devices are being developed to address fine particulate emissions.

Public Decision Making / Public Acceptance

Capital projects for Vermont schools are bond-financed and require voter approval. All wood energy projects have been initiated by one or more individuals who act as "champions" for the concept. Typically these individuals are school administrators, school board or building committee members, or involved townspeople. The idea of heating with local biomass waste fuel is generally explored by a facility committee or building committee, in a process that may last a year. The process includes carrying out an analysis of the project cost-effectiveness, learning about the technology and the fuel source, and visiting sites of successful wood boiler systems in schools or other institutional settings. At the end of this period, the committee brings a recommendation to the school board. If the board agrees with the committee's recommendation to proceed with the project, public meetings are held to inform the voters, to answer questions and to address taxpayer concerns. The decision making process culminates in a town vote. Small towns may conduct a voice vote during the annual school meeting while larger districts typically use paper ballots at the time of a general election.

The success rate of bond votes for wood energy systems in public schools can be linked to the high level of public involvement in the planning process. The first of this generation of wood-heated schools voted the system in on a unanimous voice vote at town meeting in 1986. Since that time, most bond votes for school wood projects in Vermont that have been brought to the voters have passed, usually on the first vote.

Factors Influencing Successful Spread of the Technology

The steady increase in the number of schools in the Vermont heating with wood has not been the outcome of a specific program or policy initiative, but rather a result of a number of disparate factors that have combined in a mutually supportive way.

(1) State Policy Support: While state policy has not been the driver for implementing school wood energy systems, it has played a critically important role in supporting the trend. Strong, coordinated state

support from the state energy office, the forestry department and the department of education has given an official "stamp of approval" to wood energy in schools. State officials work with local school committees to provide technical information and assist in public education.

(2) Construction Aid Assistance: Like other school construction and renovation projects, wood energy systems have generally qualified for 30% state aid to education grants.

(3) Attractive Project Economics: The cost of wood chip fuel has generally been 30-50% less than that of no. 2 (distillate) fuel oil, the primary competing fuel in Vermont. Combining this with 30% construction grants and the typical 15-20 year bond period, most school wood projects achieve positive cash flow in the first year. Early wood projects tended to be conversions from electric heat, with energy cost savings of 75-85%.

(4) Ready Supply of Wood Fuel: Vermont is 75-80% forested and the forest products industry is an important and visible part of the state economy. Wood has been readily available to schools throughout the fifteen year period and the number of suppliers catering to the school market has increased steadily. The state has assisted schools in finding fuel suppliers and has helped to create a viable chipped wood market. Wood price has increased less than 1% per year, from $25 per green ton in 1986 to a weighted average of $28 in 2000.

(5) Strong Environmental Ethic: Justification of projects on the positive aspects of using local, renewable resources appears to resonate strongly with Vermont voters. Taxpayers see wood energy systems as a form of local control and as a way of exerting independence from global fossil fuel markets and their fuel price volatility. The idea of heating the local school with waste wood from the local forest industry, while keeping energy dollars in the local economy, has had a great common-sense appeal to voters.

(6) History of Successful Applications: School districts considering wood systems can look at a fifteen year history of successful applications of the technology and visit user schools similar to their own. Wood systems receive high marks from superintendents, principals, maintenance staff and school boards in the districts where they are operating. Repairs costs have generally been low, fuel cost savings have been as predicted and maintenance staff typically spend less than a half hour daily in servicing the systems.

(7) Competitive Vendor Market: Acceptance of the technology of automated institutional wood heating systems has been positively influenced by the few vendors who actively address this market. Aggressive marketing and innovation driven by competition have been powerful forces in the spread of the technology.

Potential for Market Expansion

While the market for wood-fired school heating systems has grown slowly and incrementally, at only a few schools each year, the groundwork has been laid for a much more aggressive rate of growth. The success in establishing institutional fuel markets for low-grade chipped wood, the refinement of the biomass energy conversion systems over time, and the experience in working with local decision makers make it possible to craft public policy and program initiatives that could ramp up implementation significantly, in Vermont and other states. Such initiatives should increase vendor competition and spur the system vendors to ramp up manufacturing capability and drive down system cost.