

# CHADRON STATE COLLEGE

## *Its Wood-Chip Fired Heating Plant and Attendant Fuel Supply System* Site Visit 3/10/2005

Chadron State College (CSC), Chadron, Nebraska, is now in its 14<sup>th</sup> year of firing its central steam heating plant with wood chip fuel produced by a local supplier. Their experience and knowledge gained over that period has application to the present Fuels for Schools (FFS) situation.

Fifteen years ago CSC was heating its 20 buildings (approximately 1,100,000 square feet) with natural gas fired boilers. When an engineering analysis indicated they could significantly reduce fuel costs by heating with wastewood, they installed two Hurst wood fuel boilers—150 and 250 horsepower. The theory behind this was to work the boilers as hard as possible, using only one when practical to do so. The gas boilers were retained as backup. The million-dollar project was financed over a ten-year period, but paid out in seven.

John Hahn of nearby Hay Springs has been the fuel contractor from the start. Originally, he owned a small sawmill and logging operation and supplied the school mostly with mill waste. Two problems led to using only wood chips as fuel: adequate supply of mill waste and the fact that sawdust does not work well through the system. Hahn no longer has the mill and the only logging he does is an occasional small job with the non-merchantable chipped as part of his fuel supply. Chips come almost entirely from logging slash.

Ed Hoffman, Vice President for Administration of CSC, has been the force behind conversion, is thoroughly knowledgeable and readily accepts a role as a missionary for use of biomass as a renewable source of energy. Concern about the high cost of electricity, particularly for air-conditioning, led CSC to an evaluation of how the addition of co-gen might fit into the mix. Their engineering study indicated that while generation of electricity was not economically desirable, the installation of absorption chillers, using surplus steam for power, would result in sizeable cost savings. Hence, the school installed the equipment last year, de-bugged it in September 2004, and will operate it this coming season. They anticipate only a 700-ton per year increase in fuel consumption.

CSC uses about 8,000 tons of woodchip fuel annually, from a low of 7,000 to a high of 9,000. This comes almost entirely from chipped logging slash in “pine ridge” ponderosa pine type. The timber is similar to that encountered in southeast Montana’s “pine hills country,” i.e. short trees with a lot of wood in limbs and tops after one or two logs are taken out. Enough logging goes on that CSC is not concerned over future supply—logs go to Hulett, Wyoming or Sturgis, South Dakota. Hahn operates almost entirely on private land with some volume coming from state school lands and a nearby state park. Nebraska National Forest lands are also in reasonable proximity, but to date have not figured in, mostly because the volume is not necessary for supply and because he doesn’t want to deal with the “red tape” of purchasing material from the Forest Service.

The plant has a below-grade concrete storage bin with a hydraulic floor. It is designed to hold 100 tons, but experience showed that 100 tons is too heavy for the hydraulics, so they keep it at about 50 tons. During extremely cold weather the plant can burn 50 tons per day, but this is a rare occurrence.

Trucks unload directly into the bin or in an open-air stockpile some 150 yards away. The bin is fed from the stockpile as needed by a front-end loader with a 1-ton bucket. CSC tries to maintain the stockpile at about 1000 or 1200 tons until May when Hahn ceases chipping and the school uses up the reserves. This also provides a necessary “maintenance period” for both CSC and John. Chipping starts again in July.

Open stockpiling has worked very well. Much of the advice the school has followed in managing fuel reserves comes from the National Arbor Day Foundation and the Forest Products Laboratory (see “*Trees for Fuelwood—a Step Toward Energy Diversity*,” National Arbor Day Foundation, 1993. This publication contains information on the dynamics of open storage that will apply to future plans of FFS.)

Annual precipitation at Chadron is about 15 inches. This, along with winter temperatures, is similar to the Bitterroot Valley, and water and freezing have not been significant problems.

John Hahn and CSC have worked out a system that works quite well for them. John is paid by the “dry” ton. He lines up his supply well in advance so that the slash piles can dry from six months to a year before he chips them. Moisture consistently runs in the twenty percent range. A little more drying can take place in the stockpile.

The current year’s contract price is for 50% fuel moisture chips at \$24.22 per ton. The actual price paid with chips running in the 20-25% range is between \$35.00 and \$40.00 per ton. John bills the school at two-week intervals. The school periodically tests moisture content rounded to the nearest 5% and reconciles moisture content and price when issuing payment. They say consistency in delivery makes reconciliation easy and it is not an issue with them. Consistency in “aging” the slash seems to be the key.

John has two ten-wheeler trucks with 22-foot covered boxes and live floors, with a capacity of about 10 tons of chips. His chipper is a Morbark 30-36 with a 330 hp Cat engine. He uses a Cat skidder with grapple to pull slash out of the piles and supply the chipper which blows directly into the truck. Production varies, but in good going he loads a truck in about 20 minutes. The day I visited him he started at about 7:30 a.m. and by 4:30 pm would deliver 8 loads (80 tons) to the college. The haul was about 15 miles. His “crew” consisted of himself and another truck driver/operator (they load their own trucks) and his college-student son who ran the skidder to supply the chipper. When his son is not available, John and his other driver load both trucks at once, one chipping and the other running the skidder.

John’s advice to someone getting into the wood chip business is to buy the heaviest equipment you can get to reduce wear and breakage. He never buys new equipment, and being a farmer/logger/sawmiller by circumstance and nature, does his own maintenance and re-conditioning. His equipment looks new.

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Photo 1: Chadron State College's heating/cooling plant. Fuels storage and biomass boilers are in near portion, original gas boilers in center, and absorption chiller in far end. Cooling tower shows above far end. Front-end loader in shadow at left is used to feed the plant from open storage pile. Bucket holds 1 ton.



Photo 2: Truck with live floor unloading 10 tons into below-grade storage bin.



Photo 3: From front of the plant, turn 180 degrees and look south. Open ship storage pile shows off left edge of the shed roof. Pile is about 150 yards from heating plant. Plant is fed by front-end loader as needed.



Photo 4: Trucks unload either at the heating plant or the open storage pile depending upon need. CSC tries to maintain piles at about 1,000 tons. In the picture pile is estimated at 800 tons. Chips are used within a year.



Photo 5: In the woods the chipper is a Morbark 30-36 with a 330 horsepower Caterpillar engine, considered near optimum for the operation.



Photo 6: Chipper is hitched to truck with pintle hitch for stability and blows load directly into the truck. In good conditions it takes about 20 minutes to load 10 tons.



Photo 7: Chipper cannot work directly out of slash piles as it would necessitate constantly moving the unit. Chipper is fed by a log skidder with hydraulic grapple to optimum production.



Photo 8: Skidder positioning slash within reach of chipper's grapple.



Photo 9: No caption.



Photo 10: No caption.



Photo 11: No caption.



Photo 12: About maximum size whole-tree chipping: a 14" ponderosa pine tree with guts, feathers and all.



Photo 13: Moving the chipper to the next pile. Pile estimated to contain 20 truckloads of chips.



Photo 14: The dog is a vital part of the operation. Her job is chasing the rabbits that come out of the piles.



Photo 15: New pile with skidder tearing it apart and feeding the chipper.



Photo 16: Loaded with 9.9 tons and headed for town 15 miles away. Loads are weighed at local grain elevator before delivery.