

PINYON TO PELLETS

Partners

**BLM Colorado - BLM Uncompahgre Field Office – Forest Energy Corporation
Mountain Studies Institute – Colorado Wood Utilization and Marketing Program
US Forest Service**



Avon Hotel in Silverton, Colorado

The Pinyon to Pellets project is part of a larger endeavor called Beyond Firewood and Fence posts: Exploring and Expanding the Commercial Potential of Colorado's Pinyon-Juniper Woodlands. Beyond Firewood and Fence Posts is an on-going partnership between the Bureau of Land Management (BLM) and the Colorado Wood Utilization and Marketing Program (CO Wood) to search for enhanced and increased commercial opportunities for woodlands management byproducts. Go to WWW.COLOSTATE.EDU/PROGRAMS/COWOOD to learn more about efforts and outcomes.

PELLETIZING PINYON

Forest Energy Corporation (FEC) of Show Low, Arizona began experimenting with a whole tree pellet (WTP) product in 2004. The aim is to convert more forest restoration byproducts into a saleable product. As the name implies the WTP utilizes an entire tree: limbs, bark, needles, and all. The higher ash content in this product makes the pellets ideal for commercial boilers and furnaces or newer pellet stoves such as the Harmon P61A stove involved in this experiment.

The Beyond Firewood and Fence Posts project is testing and researching the potential for wider use of pinyon in both solid wood and value-added applications. Biomass options are the most likely given the current harvest costs and methods. With active participation from the BLM Uncompahgre Field Office and FEC, testing pinyon in the WTP making process, demonstrating WTP effectiveness, and illustrating the connections between renewable energy technology and the health of Colorado's forests have occurred. Additional partners include BLM Colorado, U.S. Forest Service, CO Wood, and the Mountain Studies Institute (MSI). The MSI is headquartered in the 102-year-old Avon Hotel in Silverton, Colorado and was selected as a demonstration site due to its location at 9,318 feet and dependence on propane. Through a cost-share agreement, a Harmon P61A stove was placed in the Avon. During the 2005 heating season, using WTP only, the stove heated nearly half of the 10,000 square-foot building and helped realize an energy savings of \$1,500 – these savings translate to a three-year payback. The Harmon pellet stove made it possible for the Avon Hotel to showcase the benefits of WTP and host the ceremonial opening of the first bag of the Colorado Pinyon WTP.



Congressman John Salazar

In October 2006, U.S. Representative John Salazar opened the first bag of Colorado Pinyon WTP at the Avon in Silverton, Colorado. Over 40 proponents of sustainable forestry and renewable energy as well as media from around the region attended the event. FEC produced the WTP entirely from pinyon trees sourced by the BLM Uncompahgre Field Office.

EXPERIMENTATION WITH COLORADO PINYON IN PELLET MANUFACTURING

Staff from the Uncompahgre Field Office delivered 58,160 pounds or 29 tons of green whole pinyon tree chips to the Intermountain Forest Resources mill site in Montrose, Colorado. FEC transported the chips to their Show Low, Arizona facility about a month later. Upon arrival in Show Low, the chips weighed in at 42,140 pounds or 21 tons (a 16,020-pound water weight loss). The chips were stored outside at the mill and later in Show Low, allowing weathering to continue moisture reduction.

The first opportunity to pelletize came during wet weather, several weeks after delivery to the Show Low Plant. The moisture content checked at 58 percent – too wet. The chips were pelletized five weeks later when the moisture content dropped to an average of 40 percent throughout the chip pile. The finished pellet is 6 percent moisture content. The 34 percent difference results from water evaporation, not a loss of wood content.

This was the first FEC pinyon run through its plant. In order to conduct the experimental run, they stalled on-going pellet production and emptied the feed and storage systems. The test run netted five tons of bagged Colorado Pinyon WTP out of 16 tons of raw pinyon material. The additional five tons was not used because of an equipment malfunction. It would have taken a greater quantity of pinyon to restart the process effectively. On a sustained run, the waste would be insignificant. This has nothing to do with normal pelletizing operations where virtually nothing but water is lost in the process. Bone dry tons of raw material (fiber and lignin) into the plant equal the bone dry tons of pellets out of the plant. In terms of volume, three to four tons of raw material yields one ton of pellets due to the compaction that takes place in the pelletizing process. In terms of weight, what fiber goes in comes out. No fiber is lost or consumed in the process

TESTING

Quality control tests for pelletizing fuel include ash, moisture, and fines/density. For this small experiment, the goal was to learn how pinyon reacts to the pelletizing process. Ash data was collected as well as the moisture readings stated. Strength tests were not conducted. This test consists of measuring the amount of fines produced by crumbling the pellets in a controlled environment. In the U.S. pellet industry, the fines/density test is the equivalent of strength or durability tests. Though not exactly a durability



Forest Energy Corp. - Show Low, Arizona

test, the results of fines/density testing reveal a pellet's durability. Low density or high fines indicate a "soft" pellet. The Pellet Fuels Institute (PFI) does not require "strength or durability" tests in their standards. It is mostly done in Europe and not common in the domestic industry.

PFI's "fines" standard is less than 0.5% by weight passing through a 1/8" screen. One test was conducted on the pinyon pellets with the result of 0.47% fines. PFI's "density" standard

is greater than 40 pounds per cubic foot. Two density tests were conducted on the pinyon pellets and both were just over 41 pounds/cubic foot. These pellets met both of the standards so durability is good.

FEC staff separated needles, bark, and white wood in several small samples taken from several larger samples and then ran ash analysis on each sample batch. The ash content of the white wood only (clean chip) tested 0.4 to 0.5 of 1% ash by weight. The needles and bark tested close to 3% and the combined "whole tree" mix made a pellet that tested 0.77 - 1.15% ash. Premium grade rating is currently anything less than 1% ash. For the "whole tree" mix, four samples were taken to get the 0.77 - 1.15% range. Further sampling would be needed for the whole tree mix and the raw material prior to commercialization of this product.



Colorado Pinyon Chips

CONCLUSIONS AND NEXT STEPS

FEC concluded that pinyon is a viable raw material for pellet manufacturing. Its use in the future will depend mainly on the developing market for local pellet fuel, access to pinyon, and pinyon harvesting cost. Much larger volumes of material will need to be processed in order to collect more data. FEC is opening a Colorado pellet manufacturing facility in northwestern Colorado in 2009. Pinyon will be considered as part of their on-going market and supply development strategy.

WTP testing has been conducted in the past with similar results. In 1984, J. Bradfield and MP Levi of North Carolina State University in Raleigh, North Carolina published an article in the Forest Products Journal documenting experimentation with a whole tree pelletizing process for six common southern hardwoods and loblolly pine. They reported that pellet furnishes were blended to test the effect of different wood-to-bark ratios on pellet durability and production rate. A ratio was chosen to simulate the wood-to-bark ratio found in whole tree chips. This furnish produced good quality pellets for all species tested. Pelletizing of the pure wood of hardwoods was not successful; furnish routinely blocked the pellet mill dies. Pure pinewood, however, did produce acceptable

pellets. It was noted that due to lignin and extractive content resulting in increased fines, the whole tree mix was less desirable in the marketplace. The marketplace referred to residential stoves. New pellet stoves are less susceptible to ash and fines today.



Pinyon Harvest near Montrose, Colorado

PELLET DESCRIPTION

Pellets are generally made of compressed sawdust or wood shavings though more manufacturers are using all components of the tree. Because they are compressed, pellets offer a more concentrated form of fuel than wood chips. Consequently, they need less storage space and are easier to handle. Their manufacture requires more energy than wood chips and the capital cost for a production plant is significant. According to FEC, a small operation ranges from \$2 million and \$3.5 million to set up and a larger facility ranges from \$6 million to \$9 million. The pelletizing process consists of hammer milling, screening, drying, and pelletizing the wood either with a roller type pellet mill or with a pellet puncher type press. Pellets are about 1 centimeter in diameter and 1 to 2 centimeters long.

REFERENCES

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Forest Energy Corporation WWW.FORESTENERGY.COM

Pellet Fuels Institute WWW.PELLETHEAT.ORG

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