**Biomass Stove Design Project: Automated Fuel Feeder System**

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**Abstract**

The purpose of this project was the research, design, and fabrication of a biomass production and feeding system for the application of alternative heating methods for small structures on campus. The biomass material to be utilized consisted of the waste sawdust produced by college industry. The research group reviewed existing literature and current manufacturing practices. Samples of production grade materials were obtained for comparison testing with regard to energy potential. The current project concluded with the design and manufacture of a functioning prototype for initial pellet production for testing. Future research will continue to revise the prototype while producing viable comparison material for further data collection and analysis prior to implementation.

**Summary Report**

This creative project, with the support of the Undergraduate Research and Creative Projects Program (URCPP), sought to utilize available waste materials in an attempt to harness energy for selected site heating. The identified waster material was the saw dust produced by Crafts Industry. The defined location for research and installation was Clover Bottom Cabin, but any successful work could also be implemented at other small campus structures.

A full exploration of the project was undertaken. Literature, schematics, and demonstrations were sought and utilized to aid the research group in understanding the scale and depth of the project. The group began looking into plausible wood boilers for the suggested sites, but quickly redirected its focus to the burnable material itself. The composition and form of the material overtook the project. After spending a lengthy amount of time reviewing available literature and visiting local professional industries dedicated to the production of burnable wood/biomass products, variables began to become identified and/or accounted for through testing/measurement.

The research group set to the task of testing samples of production grade wood briquettes and pellets while commencing the design and production of our own, small scale pelletizer. As suggested in the reviewed research, the pellet form, though consumed more rapidly, produced less ash after ignition and converted more of its potential chemical energy into viable heat. The production of our own pelletizer was to produce a collection of pellets to test against the production grade products. Once produced, our pellets would be tested for moisture, potential chemical energy, and rate of consumption.

The research group dived into the design, manufacturing, and testing process. With the assistance of Dr. Jay Baltisberger, the group was provided instruction and access to a bomb calorimeter to more accurately measure potential chemical energy in the samples. While this initial data was collected on production grade materials, the group established specific design criteria, developed models and drawings using 2D/3D software, and discussed possible equipment and energy needs to accomplish each. Once a refined collection of designs had been developed and approved by the group, fabrication of the machine began.

The research group spent the remaining time machining parts for the designed pelletizer (via manual and Computer Numerical Control (CNC) machining). The final result was a working prototype. Unfortunately, at this point in the project, the eight-week summer research time allotment concluded. The research group was very happy to get the prototype completed and perform a successful test run, but all are eagerly looking forward to completing the work during the upcoming fall/spring semesters. It is hoped that once the group is successful at producing viable pellets (and those have been tested), that the group can then move on to implementing the device for semi-autonomous operation and testing.

As stated in the project proposal, this creative research project was simply the first step in what may become a continually revisited research opportunity for several students, faculty, and staff across the campus. Also, a feeder system will also need to be designed and fabricated; therefore, future class/research opportunities are likely possibilities in addition to future URCPP applications.