EXECUTIVE SUMMARY: MNVAP is researching the application of a Kinetic Disintegration System ("KDS") to biomass pellet production. The biomass pellets can then be more efficiently transported, stored and utilized for the generation of power in facilities that cannot accommodate raw biomass as a feedstock. The KDS technology is capable of handling a wide variety of feedstocks that have varying levels of moisture. In previous milestones MNVAP has determined the baseline performance of the KDS and began to design and integrate components necessary to prepare the biomass material which will be fed into the KDS.

In Milestone #4 MNVAP has continued to design, fabricate and integrate additional components that will process the biomass material before it is fed into the KDS. These components include machinery to blend, convey and dry the biomass so that the feedstock to the KDS has consistent and uniform properties. For efficient pellet production, it is important that the biomass feedstock properties are consistent. To assure consistency, the material entering the KDS needs to be processed for uniformity in size, moisture, and density. MNVAP designed and fabricated the blending, conveying and dryer equipment required for feeding biomass into the KDS.

Designing and integrating the conveying and dryer equipment flows accomplished two critical areas for completion of the project goals. First, this will allow for initial KDS testing and evaluation to collect performance data to identify functionality and feasibility of the KDS. Second, it addressed where in the current MNVAP pellet production process the KDS would be located. Design and integration of the conveying and dryer equipment permits data collection information to be obtained at a test level to identify functionality and feasibility of the KDS and replacement of a portion of the
rotary drum dryer and final hammer milling process. After efficiency evaluations and testing, modifications will be made to the KDS design for improvements in the process flow and product quality.

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TECHNICAL PROGRESS: Gaining knowledge of the KDS is a main goal for this project. Knowledge gained by initial pilot-scale research leads to formulating a scale-up for incorporation of the KDS into MNVAP's current pellet production process. AMEC E&C Services were contracted to engineer and design fiber conveying and dryer systems to support the KDS system within the MNVAP plant dependent on positive economic performance of the KDS.

A belt conveyor made by Swift Manufacturing was installed to feed the KDS. MNVAP chose a belt conveyor so that the biomass fibers would not be lodged and create blockage. An auger system may plug up with wetter biomass. The conveyor is custom made for the height MNVAP needed to reach the top most airlock. The conveyor is 42” wide and 45’ long and has the capacity to convey raw biomass between 20-30 tons per hour. Diagram 1 provides a visual of product flow through MNVAP’s pellet production process with the incorporation of the KDS. The current classifier for the KDS had to be replaced to be competitive with MNVAP’s current grinding. The classifier is located in the grinding chamber above the knives. The classifier’s purpose is to determine size and completion of grinding. It uses air to push thru the classifier. If particles are less than 2 inches they will pass through, and the batch of biomass will be completed. A “VFD” was added to the classifier to control the speed. Two process lines have been put in place for product and efficiency evaluation. One process line is the existing biomass material processing system used by MNVAP. The second process line includes the KDS for processing material.

MNVAP’s current processing systems requires biomass fibers to go through a shredder process and two hammer mills. First a rock crusher hammer mill which reduces the length of the long stem alfalfa fibers before the biomass goes onto a rotary drum dryer. After drying, the biomass goes through a 500 Hammer Mill for the final milling process. The KDS is intended to divert material flow going to the rotary drum dryer and the final hammer milling process. Having the KDS perform both a drying and milling process is expected to be quicker and more economic than the current process. Project research is to substantiate this hypothesis.

ADDITIONAL MILESTONES: Milestone 5 requires a different style of knives for the KDS, which were ordered, along with a different classifier for the KDS. A variable frequency drive (VFD) was purchased to control the speed of the classifier.

PROJECT STATUS: Design and integration of the conveying and dryer equipment permitted data collection information to be obtained at a test level to identify functionality and feasibility of the KDS system replacing a portion of the rotary drum dryer and final hammer milling process.
APPENDIX:

Diagram 1 Material flow through the MNVAP process

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Diagram 1 – Material flow through the MnVAP process.